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Economy in Press Tool Design

By W. E. Irish

Associate Editor, *American Machinist*

TOOLS made for press work on typewriter parts are usually of no great bulk. Standard die shoes can be applied nicely, and perforating work in strip stock is the principal item.

Punches, bushings, stops, strippers, dowels, and inter-part fastenings, those items which recur most frequently, are, therefore, the parts to be considered.

The problem has been handled to advantage by the Corona Typewriter Co. on its drawing No. C-615, shown in Fig. 1, and called the "Guide Sheet for Designing and Building Pierce and Blank Dies." At first sight, the drawing itself does not appear to be particularly comprehensive. As it is picked apart, however, its range of usefulness becomes evident.

An imaginary tool is designed for perforating and blanking a piece of irregular shape. The piece has to be notched on one side, and includes three perforations before being blanked out of the strip stock. Two of these perforations are circular, and one is oval in shape. The two circular perforations could be used as locating points for the stock advance were they larger, but it is desired to also cover the design of locating pins in the strip outside of the regular work. A piece of the work is shown and a diagram of the scrap strip is illustrated in Fig. 2 to assist in the explanation.

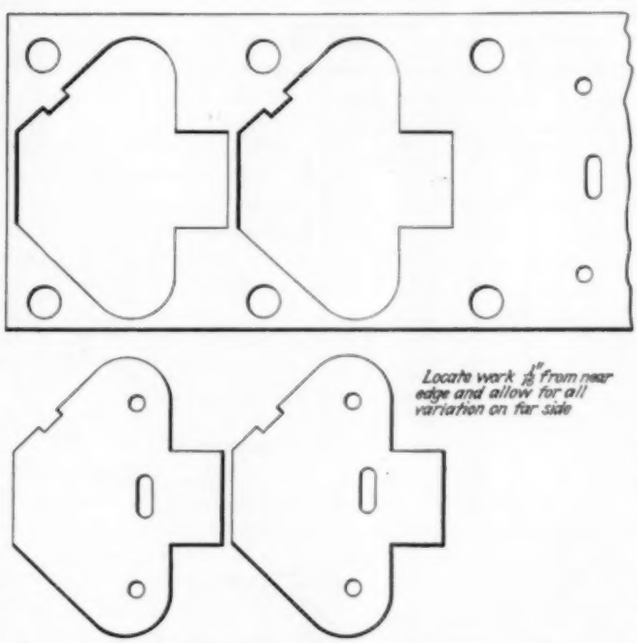


Fig. 2—The work-piece and its strip stock

The actual sizes of punches and bushings are not shown, as actual conditions for a particular tool cause these points to be variable and beyond the company's aim at standardization.

At *A* in Fig. 1 is shown a top view of the die and stripper dowelled and bolted together and fitted with the stripper bushings and work stops. The insert used for putting the required notch in the work is also shown.

Below this view, at *B*, is shown a side view of the punch plate with the punches in position. The small punches, to the right, perforate the circular holes in the part that is, later, to be blanked from the strip. The next two, to the left, perforate the guide-pin holes in the strip, while the next single one puts the oblong hole in the part. The next two pointed punches serve as guide pins in the holes previously perforated. Next, to the left, is the blanking punch. In it, there are two more guide pins to register with the holes punched in the strip by the first punches to the right. It is evident that both sets of guide pins are not necessarily required in the tool. They are shown to indicate arrangement as a standard rather than for actual use.

Locating pins are indicated for the stripper bushings which serve to guide the piercing punches, but not for those in which the main guide pins register. The reason for this construction is that unnecessary work is involved by making all of the bushings adjustable. The guide pin holes are located centrally, and any correction needed to make the punches register is accomplished by the use of eccentric punch bushings that can be turned until they fit perfectly. These are then pinned in position. This arrangement of punches calls for three stops, two for starting and one for working, by which the end of each new strip can be progressively registered prior to completion of the first blank. Parts of the stop construction can be seen in the views at *A*, *C*, *E*, *F* and *G*.

Referring to view *A*, the stock is entered from the right and registers against the first starting stop for perforating the guide-pin holes in the strip and the two small perforations in the part. This stop is pulled out, after the press has been tripped, and the strip is advanced to register against the next starting stop to the left. In this position, the guide pins register in the holes just punched and the oblong hole is perforated. The part is then ready to be blanked from the strip, when the second stop is pulled out and the

The first of a series of articles on press tool design for typewriter parts. The second will appear in an early issue.

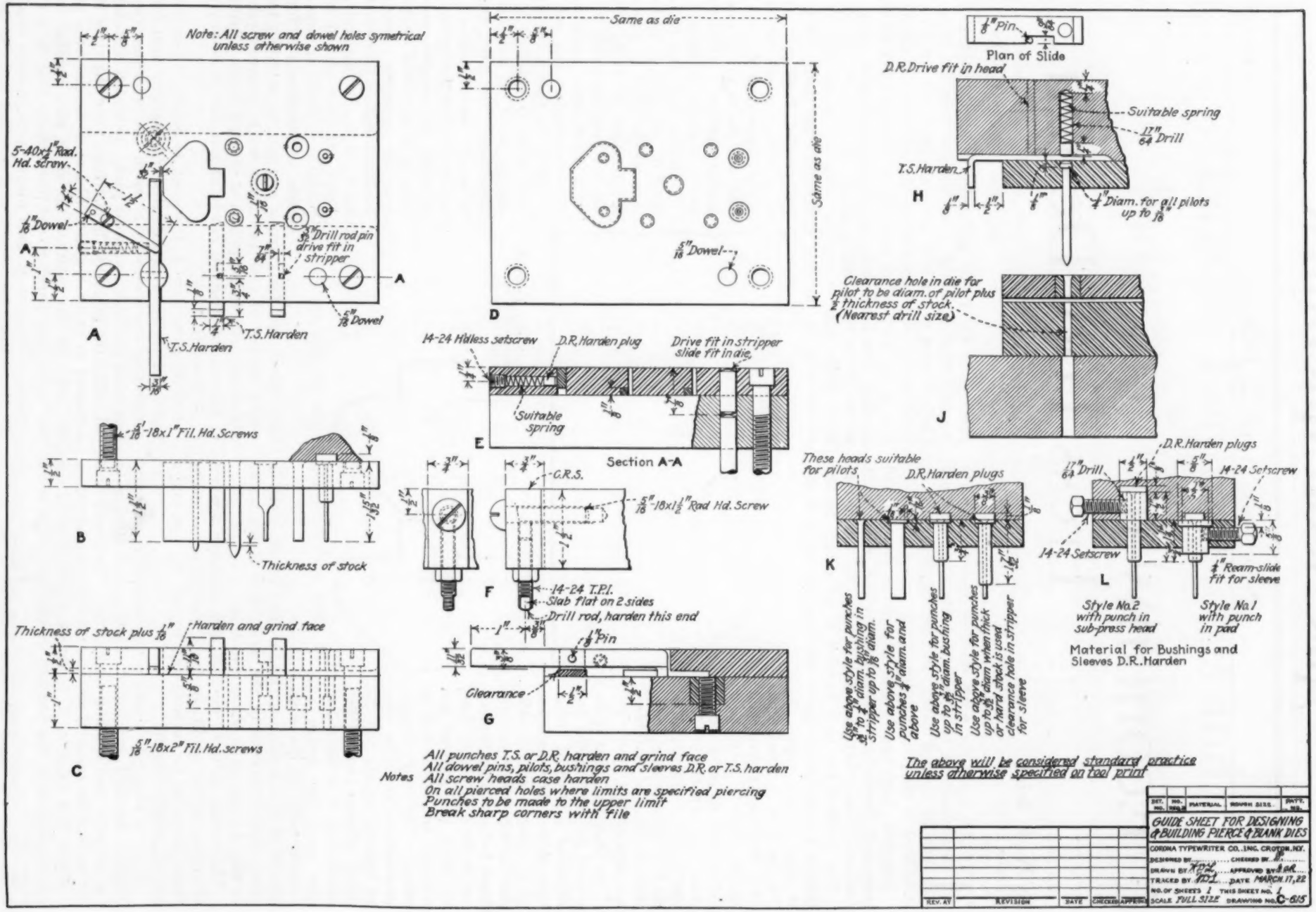

Note: All screw and dowel holes symetrical unless otherwise shown
5-40x1/4" Rad. Hd. screw
1/16" Dowel
3/8" Drill rod pin drive fit in stripper
5/16" Dowel
T.S. Harden
A
B
5/16"-18x1" Fil. Hd. Screws
Thickness of stock
C
Thickness of stock plus 1/16"
Harden and grind face
5/16"-18x2" Fil. Hd. screws
Same as die
5/16" Dowel
D
14-24 Hdless setscrew
D.R. Harden plug
Drive fit in stripper slide fit in die
Suitable spring
E
Section A-A
C.R.S.
5/16"-18x1 1/2" Rad Hd. Screw
F
14-24 T.P.I.
Slab flat on 2 sides
Drill rod, harden this end
1/8" Pin
Clearance
G
Plan of Slide
D.R. Drive fit in head
Suitable spring
17/64" Drill
T.S. Harden
H
1/4" Diam. for all pilots up to 1/8"
Clearance hole in die for pilot to be diam. of pilot plus 1/2 thickness of stock. (Nearest drill size)
J
These heads suitable for pilots
D.R. Harden plugs
K
Use above style for punches 1/8" to 1/4" diam. bushing in stripper up to 1/8 diam.
Use above style for punches 1/4" diam. and above
Use above style for punches up to 1/4" diam. bushing in stripper
Use above style for punches up to 1/4" diam when thick or hard stock is used clearance hole in stripper for sleeve
17/64" Drill
D.R. Harden plugs
14-24 Setscrew
14-24 Setscrew
1/4" Ream-slide fit for sleeve
L
Style No. 2 with punch in sub-press head
Style No. 1 with punch in pad
Material for Bushings and Sleeves D.R. Harden
Notes
All punches T.S. or D.R. harden and grind face
All dowel pins, pilots, bushings and sleeves D.R. or T.S. harden
All screw heads case harden
On all pierced holes where limits are specified piercing Punches to be made to the upper limit
Break sharp corners with file
The above will be considered standard practice unless otherwise specified on tool print
GUIDE SHEET FOR DESIGNING & BUILDING PIERCE & BLANK DIES
CORONA TYPEWRITER CO., INC. CROTON, NY.
DESIGNED BY ... CHECKED BY ...
DRAWN BY ... APPROVED BY ...
TRACED BY ... DATE MARCH 17, 22
NO. OF SHEETS 1 THIS SHEET NO. 1
SCALE FULL SIZE DRAWING NO. C-615
REV. AY REVISION DATE CHECKED APPROVED

Fig. 1—A press-tool standardization drawing

strip is pushed forward again until it hits the third or working stop.

The construction of this working stop is of interest, aside from the subject of standardized construction. It is, therefore, described in detail. It is made in an L-shape, as shown at *G*, with a short leg projecting downward to obstruct the passage of the strip stock. It is set to rock on a small pin so this leg can be lifted out of the way as desired. The rocker pin is set, in turn, in a plug and the assembly is dropped into a slot in the stripper, as shown at *A*, so the bottom of the plug rests on the die. The circular part of the slot in the stripper is a running fit to the plug, but the balance of the slot is wider than the stop, $\frac{3}{32}$ in., as shown. The stop can, therefore, be tipped up or oscillated sideways a small amount.

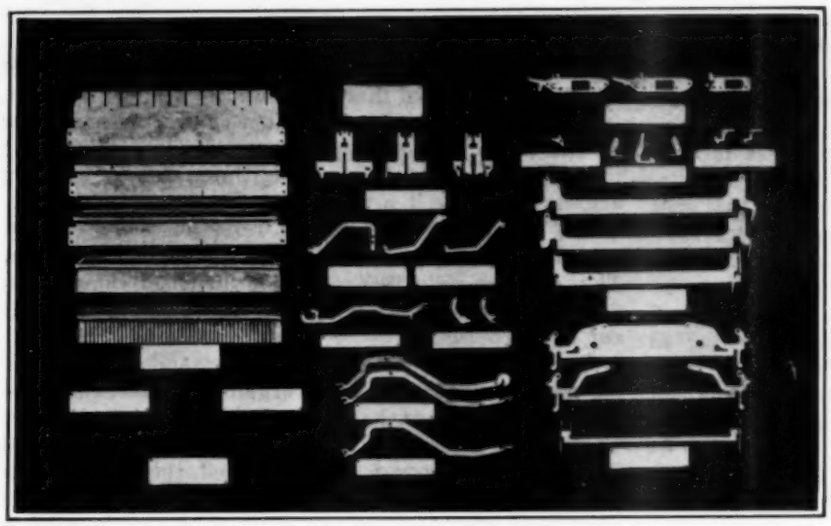


Fig. 3—A few of the parts on the operation board

A flat spring, secured on top of the stripper, bears down on the stop to hold it in the slot and to keep the projecting L-finger down in contact with the die. A spiral spring and plunger, set horizontally in the stripper, holds the stop to that side of the slot from which the stock advances.

The strip stock is advanced to the stop and pushes it to the opposite side of its slot against the comparatively weak resistance of the spiral spring. Then, upon tripping the press, an adjustable plunger, as shown at *F*, descends with the punch to which it is attached. This plunger registers on top of the stop arm, where it projects beyond the stripper and tips it on its rocker pin. This brings the L-projection up above the end of the strip to a point where the spiral spring is free to push it to the right-hand side of the slot. When the punch returns upward, the flat spring brings the stop back to horizontal again, but this time to land the L-finger on top of the strip, due to the slight side movement. The strip is, therefore, free to be advanced until the finger again falls to contact with the die through the hole in the strip that was made in the last blanking stroke.

There are a good many cases in which the guide-pin holes cannot be punched at the start without some part of the blank stock coming under the guide pin. This condition is met by the standardized design, shown at *H*, of a disappearing guide pin.

The pin itself is set, as shown, in the punch plate and is backed up by a slide. The slide can be moved out to a position that clears the head of the pin. Above the slide, in the body of the punch, a hole is drilled out and is fitted with a spring and plunger. When the guide pin would otherwise perforate the blank stock, the slide is set to allow it to back up into the punch body.

Experience has shown that, when the pin is accidentally forced through the stock, a certain size of hole in the die is best to let the pin break through clean so the strip will not stick and so danger of bending or breaking the pin is minimized. This has been set at a clearance on the pin diameter of one-half the thickness of the stock. The point is noted at *J*. It will be seen, also, that the stripper plate and not the die is used to guide the locating pins, which is as it should be.

There are a number of conditions that affect perforating punch design, particularly on the small sizes. The majority of these conditions are grouped and the designs standardized at *K* and *L*, as shown.

The punch to the left, at *K*, is used on sizes between $\frac{3}{32}$ and $\frac{1}{4}$ in., in connection with a guide bushing in the stripper on sizes up to $\frac{1}{16}$ in., beyond which the punch is sufficiently strong to not require the stripper bushing support. The punch of this design is made by upsetting one end of a piece of the drill rod, on which the company has standardized, within a certain upper size limit. The punch plate is simply countersunk with

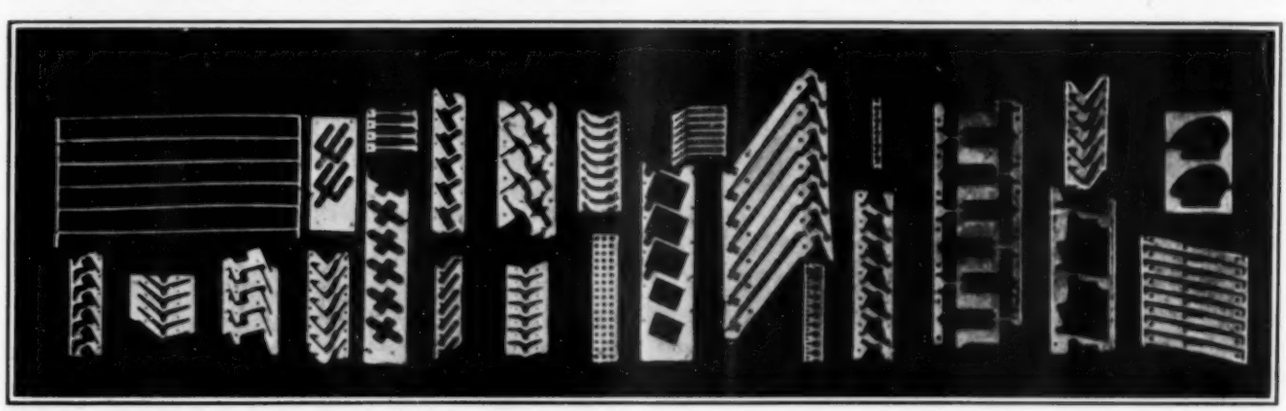


Fig. 4—Samples of strip scrap showing nesting on the operation board

the usual tools to accommodate this simple style of head.

The next punch design, to the right, is used for sizes of ¼ in. and larger. It is machined to a shoulder head for which the punch plate is counterbored. The third punch from the left is used in sizes up to ⅛ in. with a guide sleeve provided in the punch plate. On this punch the head is too small to allow the punch block alone to back it up. The block is, therefore, counterbored and fitted with a hardened plug. The plug itself is also set into a steel sleeve that, in turn, fits through the punch plate.

The punch design to the right in this set is used on sizes up to ⅛ in. when there is danger of breakage, and as a result a reinforcement is needed. To this end, the punch sleeve is extended through the stripper position and the guide bushing in the stripper is omitted.

There are times when it is highly desirable to be able to remove a punch without dismantling the tool. There are two standard designs for this purpose, as shown at *L*, one in which the punch is fitted up into the punch block and one in which it terminates in the punch plate. Both apply to punches below ⅛ in. in diameter.

That shown as style No. 1 consists of a bushing fitted into the punch plate, drilled to accommodate a sleeve similar to those shown in *K*, except that it has no head. A setscrew through the punch plate, horizontally, holds the sleeve in position. The other style, No. 2, is similar in principle, but uses a longer punch sleeve and includes a headless bushing also, in the die block. The setscrew is located in the die block and threads through the bushing to pinch against the sleeve. To change punches, it is only necessary to back off the screw and catch the sleeve and punch as they fall out. Another punch can be inserted and the sleeve replaced.

Inserts Facilitate Repairs

It is a policy to use inserts in the die construction when by so doing it is possible to facilitate upkeep and simplify repairs. One of these inserts is indicated in dotted lines at *A*, where it serves to put the notch in one side of the part. It is shown fitted into the die in section at *G*, being held in position by means of a screw through the bottom of the die steel. Naturally, it is impossible to standardize more than the height of the insert and the method of fastening.

Further inspection of this standard sheet will show numbers of other details of design, such as the methods of dimensioning the screws, locations, dowels and other holding, locating and guiding points, and locating from the near side of the strip to allow for width variation. In fact, there is very little that is not shown where the opportunity for standardization presents itself clearly.

A significant point, on the thought given by G. A. Reynolds, Production Equipment Engineer, before he completed the designs and layout sheet, lies in the date line on the title. The drawing was completed on March 17, 1922, and put into use at that time. It is still the accepted standard without any revision during the entire period.

Each draftsman has a copy for reference, as well as each of the toolmakers. When the draftsman makes up a drawing, he indicates locations of all standardized parts, but does not spend any time on detailing or dimensioning them. When the drawing reaches the tool room and is assigned to one of the men, he uses it in connection with the standard sheet. There is a gratifying saving of time in both instances.

There is one other practice inaugurated by Mr. Reynolds that is of decided assistance to the designer. It consists in posting in the drafting room a sample of each of the parts entering the typewriter assembly in each of the operations required to complete the part from the blank.

These parts, with the operations in sequence, are arranged on a board that hangs on the wall of the room. In Fig. 3 is shown a small section embracing a number of the parts. The scrap strips are also included to indicate plans of economical nesting. A few of them are shown in Fig. 4, a view of another part of the board.

The draftsmen are able to refer to the operation sequences, to study work that has been done in each. They can also judge the results of various arrangements of the blanks in the strip, to assist them in working out new problems.

There have been many plans of standardization of design worked out in various organizations. Some have succeeded. Others have slowly drifted out of use. The success of the work just described can be attributed to the care with which it was started, the standardization of a comparatively few points that would do the most good and constant watch to stop any digression before it gets well under way.

Getting Machine Tool Capacity

By Entropy

Machine tool builders are not like the restaurant keeper who went elsewhere for his lunch, in that they mostly use the machinery they build. But they do not often use it up to the capacity which some of their customers discover. In fact there is no real reason why they should, because with only a few exceptions it is easy to build machine tools without removing any very great quantity of stock from castings or forgings.

However, many machine tools are used for the building of other machines where much stock must be removed and where heavy feeds and cuts prevail. Railroad shops, engine builders and all such shops often have need for machines of much greater capacity than the machine tool builders claim. They get their work done by purchasing standard machines and then putting the load on until the builder would shudder to see it. And yet it stands up, at least for a time.

Some thirty years ago the *American Machinist* published an article, the author of which I do not recall which predicted that the time would come when the engine lathe would have a front bearing for the spindle equal to one-quarter the swing of the lathe. That is, a sixteen-inch lathe would have a spindle four inches in diameter. However, just looking at the machinery now in use it appears that we have only progressed half way to that ideal. Then the average spindle for a 16 in. lathe was about two inches in diameter; now it is nearly three inches with an inch to go yet. To be sure the spindle would be about twice as stiff as it is now if it were enlarged, and the bearing would be much more rigidly held to the bed. The builders themselves do not need this extra stiffness, but many shops do. The fact that every tool builder goes over most of his lathe work with a grinding wheel, does not help all of his customers, because some of them never think of a grinder outside of the tool room or the snagging room.

Maintenance of Gas-Rail Cars on the New Haven Railroad

A new element in railroading—Repairing gas engines at New Haven—Different types of engines used—Some appliances for handling the work

WITHIN the last few years an entirely new element has been projected into the business of railroad transportation in the shape of the independently driven car, or gas-rail car as the railroad men designate it; a composite of locomotive, passenger car and automobile, presenting some of the problems of each and demanding for its maintenance a class of skill and knowledge that is a compound of railroad instinct and automobile repair-shop experience.

Recognizing the necessity for treating the gas-driven car as a separate problem, and of training a corps of workmen to meet the special conditions imposed by it, the New York, New Haven & Hartford R.R., which now owns and operates twenty-five of the cars, has established at New Haven a shop to handle the work of maintenance.

Variety of Equipment

Besides the passenger cars, this shop takes care of many small four-wheel, gas-driven track cars that are used by signalmen, trackworkers and inspectors in their daily duty; also of gas engines to furnish power for light hoisting machinery, to turn the large turntables used in the locomotive yards, to supply air pressure for the pneumatic tools used by the trackworkers, and for many other purposes.

The power unit in most of the passenger cars is the Sterling "Sea-Gull," six-cylinder motor of 120-hp. nominal capacity. Several of the smaller cars are Mack built and are equipped with four-cylinder, 60-hp. motors, differing little except in gear ratios from the engines of standard Mack trucks.

On all but two of the passenger cars, the power transmission is through shifting gears, though there are several types of transmission. The Mack cars have four speeds both forward and reverse, driving through a propeller shaft to a single rear axle. Another type of car, the Brill, has five speeds that are applicable equally in either direction. Still another type has six forward speeds and two in reverse, made available by the application of a secondary transmission, known as the "transfer case," through which the main transmission may drive either direct, or by a two-to-one ratio, the speed changes and reversal of direction being in the transmission.

Driving Mechanism

On one type of car, the transmission case is mounted on the forward truck between the axles and drives to both axles, thus giving a four-wheel drive on the forward truck only. On each of the axles there are two bevel gears turning freely on roller bearings and driven in opposite directions by the pinion of the propeller shaft which meshes with both. Between each pair of bevel gears there is a sleeve clutch, splined to the axle, that may be engaged with the hub of either gear by means of a lever at the operator's seat. The direction of travel is, of course, dependent upon the position of this clutch, and the speed is equal either way.

On another type of car, the drive is through a long propeller shaft to one axle of both trucks, thus giving the same amount of tractive effort per unit of weight, but distributing it a little more evenly over the length of the car.

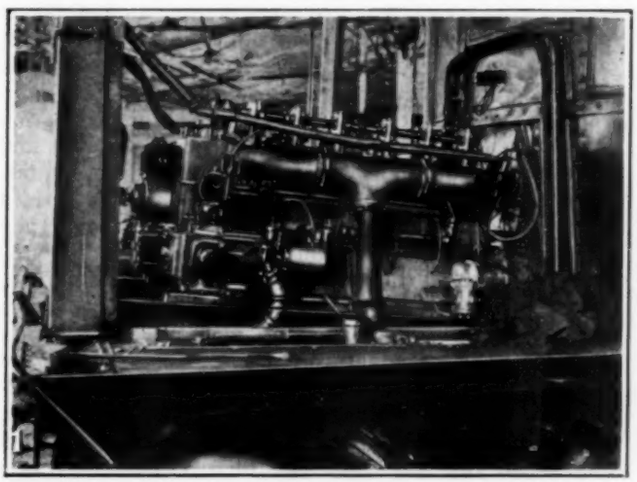


Fig. 1—A Sea-Gull motor in a gas-rail car.

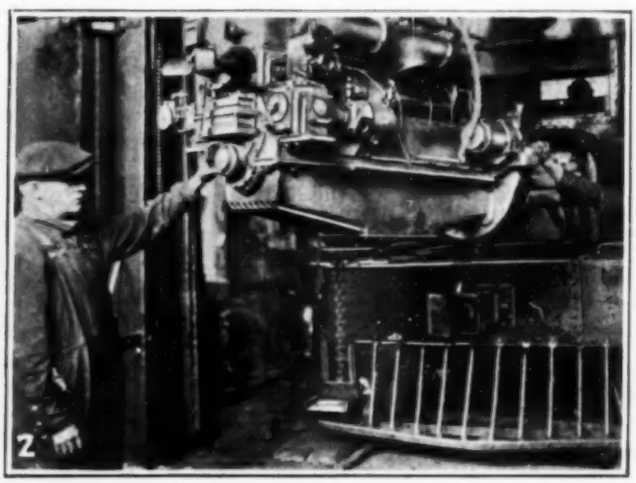


Fig. 2—Lifting the motor from a Brill car

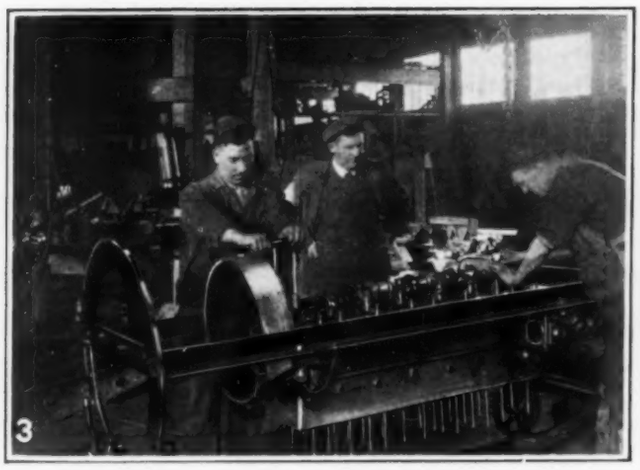


Fig. 3—A rotatable jack to hold motors while undergoing repair. Fig. 4—The same jack with position of motor reversed

On one of the passenger cars, a 170-hp. Brill engine drives direct to a variable delivery pump, and the oil from this pump is applied to two hydraulic motors, one of which is carried on each truck. The speed of the main engine remains constant while the rate of flow and direction of delivery of the oil is under control of the operator by means of conveniently placed levers, so that any speed of car up to 40 m.p.h. in either direction is available without arbitrary gradations. This device is the hydraulic power transmission made by the Waterbury Tool Company.

Another car is equipped with electric drive, giving it the same advantage of flexibility of control that is the feature of the hydraulic transmission. Electric motors, geared to one axle of each truck, are driven by the current that is supplied by a generator connected directly to the engine.

All of the passenger cars are equipped with standard, railroad air-brakes and are illuminated by electric lights. The air compressor that supplies pressure to the brake cylinders is driven by a separate shaft that derives its power through side gearing in the transmission case.

On all except the last two cars mentioned, the motors are mounted under a removable hood at one end of the car frames. Fig. 1 shows a Sea-Gull engine, from which the cover has been removed, in the location it occupies while in service. To lift it out of the car, the car is positioned under a stationary chain hoist, rope slings passed around the engine, and the engine raised clear of the car as in Fig. 2. The car is then pushed back from under it and the engine deposited upon a special jack made to receive and hold it while it is undergoing repair.

These jacks, of which the shop has a sufficient number to handle all of the engines that are likely to be under repair at one time, are provided with ball-bearing casters, so that an engine may be wheeled to any part of the shop that may be convenient for the work. The underframe of the jack is in the form of a truck, and upon it is mounted a carrying member to which the engine is attached by the same bolts that held it to the car frame.

In Figs. 3 and 4 is shown one of the jacks with an engine upon it. The rings that form the ends of the carrier member rest upon rollers that are mounted on the truck frame in such manner that the unit may be rotated about a horizontal axis, so as to bring any part of the engine uppermost. The location of the carrier bars with respect to the center of rotation is such that when an engine is bolted to them, the entire unit is as nearly as possible in balance, which makes for ease of handling and also permits the engine to remain in the position in which it is placed.

Since the center of gravity of the unit changes, however, as the parts are removed from or returned to the engine, it is necessary to provide a locking device to prevent accidental displacement. This device consists essentially of a tapered pin to pass through a hole in the stationary member and enter one of several holes in one of the end rings.

The work of repair consists mainly of adjusting the bearings, fitting new pistons and rings, and "tuning up" the engine generally. Standard and oversize parts for all the motors are carried in stock for replacements, and the work is practically all done by hand.

(To be concluded)

Characteristics of Collets—Discussion

BY G. B. STUART

The article on collets on page 512, Vol. 64, *American Machinist*, recalls to my mind a story from old Kentucky to the effect that the great hunter Daniel Boone had such a reputation amongst the foxes that whenever he came their way with a gun any fox in his path just naturally came out and gave himself up.

The efforts of Secretary Hoover's Standardization Committees, and those of the engineering societies and of the *American Machinist*, are certainly most praiseworthy, but the job of standardizing everything is a pretty big one, and it might help a lot if the manufacturers and users of machine parts came out like the foxes and helped matters along just a little more.

Collets are not the only machine parts that could be standardized with little effort. I just noticed the advertisement of a manufacturer of oil cups, who features 50 different kinds of oil and grease cups. It isn't his fault, because he has calls for that variety, and the business would go to someone else if he did not produce them. But why don't manufacturers and designers get together a little bit more with the idea of simplifying these little items?

The International Convention for the Protection of Industrial Property

The Changes in and Additions to the Former Convention Are Indicated by Italic Type in the Following Text

THE unofficial English translation of the International Convention for the Protection of Industrial Property given below, was prepared in the Office of the American Commercial Attaché, 25, Place de l'Industrie, Brussels, Belgium, in collaboration with a number of the English speaking delegates to the conference.

An article covering the problems of the Convention was published on page 461, Vol. 63, of the *American Machinist*. How successful were the American delegates in incorporating into the treaty the desires of the United States may be seen by comparing that article with the treaty here given:

The International Convention for the Protection of Industrial Property was the result of conferences held at Paris in 1883. It was signed on March 20, 1883, by 15 countries. On December 14, 1900, a revision was made and at Washington on June 2, 1911, the treaty now in force was signed. The purpose was to secure international protection for patents and trademarks and to repress unfair competition

Article 1

The contracting countries constitute themselves into a Union for the protection of industrial property.

The scope of industrial property includes patents, utility models, industrial designs and models, trade marks, commercial names and indications of origin, or appellation of origin, as well as the repression of unfair competition.

Industrial property is to be understood in the broadest meaning and is to be applied not only to industry and commerce as such, but likewise to agricultural industries (wines, grain, tobacco leaves, fruit, cattle, etc.) and extractive (minerals, mineral waters, etc.).

The term "patents" includes the various types of industrial patents granted by the laws of the contracting countries, such as patents of importation, improvement patents, patents and certificates of addition.

Article 2

Nationals of each of the contracting countries shall, in all other countries of the Union, as regards industrial property protection, enjoy the advantages that their respective laws now grant, or may hereafter grant, to their own nationals, *without any prejudice of the rights specially provided by the present Convention.* Consequently they shall have the same protection as the latter, and the same legal remedy against any infringement of their rights, provided they observe the conditions and formalities imposed on subjects or citizens.

Nevertheless, no condition as to the possession of a domicile or establishment in the country where protection is claimed can be required of those who enjoy the benefits of the Union for the enjoyment of any industrial property rights.

The provisions of the legislation of each of the contracting countries relative to judicial and administrative proceedings, and to competent authority, as well as to the choice of domicile or the appointment of an authorized agent, which may be required by the industrial property legislation, are expressly reserved.

Article 3

Nationals of countries not forming part of the Union who are domiciled, or who have real and effective industrial or commercial establishments, in the territory of any of the countries of the Union shall be assimilated to the nationals of the contracting countries.

Article 4

(a) Any person who has duly applied for a patent, the registration of a utility model, industrial design or model, or trade mark, in one of the contracting countries, or his legal representative or assignee, shall enjoy, subject to the rights of third parties, for the purposes of registration in other countries, a right of priority during the periods hereinafter stated.

(b) Consequently, subsequent filing in any of the other countries of the Union, before the expiration of these periods, shall not be invalidated through any acts accomplished in the interval, either, particularly, by another filing, by publication of the invention, or by the working of it, by the sale of copies of the design or model, or by use of the trade mark.

(c) The above-mentioned periods of priority shall be twelve months for patents and utility models, and *six* months for industrial designs and models, and trade marks.

These periods shall start from the date of filing of the first application in a country of the Union; the day of filing is not counted in this period. If the last day of the period is a dies non in the country where protection is claimed, the period is extended until the next working day.

(d) Any person desiring to take advantage of the

priority of a previous application must make a declaration giving particulars as to the date of such application and the country in which it was made. Each country will determine for itself the latest date at which such declaration must be made.

The particulars referred to shall be stated in the publications issued by the competent authority, and in particular in the patents issued and the specifications relating thereto.

The contracting countries may require any person making a declaration of priority to produce a copy of the application (with the specification, drawings, etc.) previously made. *The copy certified as correct by the authority receiving this demand shall not require any legal authentication, and in any circumstances can be filed at any time within the period of three months from the lodging of the last application.* They may also require that the declaration shall be accompanied by a certificate by the proper authority, showing the date of application, and also by a translation.

No other formalities may be required for the declaration of priority at the time of application. Each of the contracting countries shall decide for itself what consequences shall follow the omission of the formalities prescribed by the present article, but such consequence shall in no case be more serious than the loss of the right of priority.

At later stages, further proof in support of the application may be required.

(e) Where an application is filed in a country for the registration of an industrial design or model by virtue of a right of priority based on the registration of a utility model, the period of priority shall not exceed that fixed for industrial designs and models.

Furthermore, it is allowable to deposit in a country a utility model by virtue of rights of priority based on a patent application in another country, and vice versa.

(f) If an application for a patent contains claims for multiple priority, or if examination discloses that the application contains more than one invention, the competent authorities must at least allow the applicant to divide it, subject to the conditions of internal legislation, reserving as date of each divisional application the date of the initial application and, where at question, the benefits of the right of priority.

Article 4 Bis

Patents applied for in the various contracting countries *by nationals of the Union* shall be independent of the patents obtained for the same invention in other countries, whether such countries be or be not parties to the Union.

This stipulation must receive a strict interpretation; in particular, it shall be understood to mean that patents applied for during the period of priority are independent, both as regards the grounds for refusal and for revocation, and also as regards their normal duration.

This stipulation shall apply to all patents already existing at the time when it shall come into effect.

The same stipulation shall apply, in the case of the accession of new countries, to patents in existence, either on one side or the other, at the time of accession of the new countries.

Article 5

The introduction by the patentee into the country where the patent has been granted of objects manufactured in any of the countries of the Union, shall not entail forfeiture.

Nevertheless, each of the contracting countries shall have the right to take the necessary legislative measures to prevent the abuses which might result from the exercise of the exclusive rights conferred by the patent; for example, failure to work.

These measures will only provide for the revocation of the patent if the granting of compulsory licenses shall not suffice to prevent such abuses.

In all cases the patent will not be subject to such measures before the expiration of at least three years from the date of its grant and if the patentee produces just excuses.

The protection of designs and industrial models cannot be liable to cancellation by reason of the introduction of objects corresponding to those protected.

Articles shall not be required to bear any indication of registration for recognition of this right.

If in a country the use of a registered trade mark is compulsory, the registration cannot be cancelled until after a reasonable period, and only then if those interested cannot justify the causes of their inaction.

Article 5 Bis

A period of grace of at least three months will be granted for the payment of taxes prescribed for the maintenance of industrial property rights, together with a surcharge if the internal legislation of a country so provides. For patents, the contracting countries undertake, moreover, either to prolong that extended period to six months at least, or to provide for the restoration of a patent which has expired owing to the non-payment of fees. It is understood that these provisions are subject to the conditions prescribed by internal legislation of the contracting countries.

Article 5 Ter

In each of the contracting countries the following shall not be considered as infringing the rights of the patentee:

(1) The use on board ships of other Unionist countries of anything the subject matter of his patent in the body of the ship, in the machinery, tackle, apparatus, and other accessories when such ships enter temporarily or accidentally the waters of the country, provided that such thing is employed there exclusively for the needs of the vessel.

(2) The use of anything the subject matter of the patent in the construction of or functioning of the engines of locomotion for air or land of the other Unionist countries, or of the accessories of these engines, when these have entered the country only temporarily or accidentally.

Article 6

Every trade mark duly registered in the country of origin shall be admitted for registration and protected in the form originally registered in the other countries of the Union.

Nevertheless, the following marks may be refused or cancelled:

1. Those which are of such a nature as to prejudice rights acquired by third parties in the country in which protection is applied for.

2. Those which have no distinctive character, or which consist exclusively of signs or indications which serve in trade to designate the kind, quality, quantity,

destination, value, place of origin or date of production, or which have become customary in the current language, or in the bona fide and unquestioned usages of the trade of the country in which protection is sought.

In arriving at a decision as to the distinctiveness of the character of a mark, all the circumstances of the case must be taken into account, and, in particular, the length of time that such a mark has been in use.

3. Those which are contrary to morality or public order.

It is to be understood that a mark cannot be considered as contrary to public order for the sole reason that it does not conform to some legislative requirement concerning trade marks, except in circumstances where this requirement itself relates to public order.

The following shall be deemed the country of origin:

The country of the Union where the applicant has an actual and genuine industrial or commercial establishment, and if he has not such an establishment, the country of the Union where he has his domicile, and if he has not a domicile in the Union, the country of his nationality in the case where he enjoys the benefits of the Union.

In no case shall the renewal of the registration of a trade mark in the country of origin involve the obligation of renewal of the registration of the mark in other countries of the Union in which the mark has been registered.

The benefits of priority shall subsist in trade mark applications filed in the period allowed by Article 4, even when the registration in the country of origin is only completed after the expiration of such period.

The provisions of paragraph 1 do not preclude the right of requiring from an applicant a certificate, in due form, as to the registration of his mark, issued by the competent authority of the country of origin, but no legal authentication of such certificate shall be required.

Article 6 Bis

The contracting countries undertake to refuse or invalidate, either administratively if their legislation so permits, or at the request of an interested party, the registration of a trade mark which constitutes a reproduction or imitation liable to create confusion with a trade mark considered by the competent authority of the country of registration to be well-known there as being already a mark of a national of another contracting country and used for the same or similar products.

A period of at least three years must be granted in order to claim the cancellation of these marks. The period shall start from the date of registration of the mark. No period shall be established to claim the cancellation of fraudulently-registered marks.

Article 6 Ter

The contracting countries undertake to refuse or invalidate registration, and to prohibit by appropriate means the use, failing authorization from the competent authority, whether as trade mark or as components of such, all Coats of Arms, flags, and other State emblems of contracting countries, official control and guarantee signs, and stamps adopted by them, and all imitation from an heraldic point of view, of the emblems described in this paragraph.

The prohibition of official control and guarantee signs and stamps shall apply only in cases where marks which comprise them are intended to be used on merchandise of the same or a similar nature.

For the application of these provisions the contracting countries agree to communicate reciprocally through the intermediary of the International Bureau of Berne, the list of State emblems and official control, and guarantee signs and stamps, which they desire, or will desire, to place, wholly or with certain reservations, under the protection of the present article, as well as all subsequent modifications added to the list. Each contracting country shall place the communicated list at the disposal of the public in due course.

Each contracting country may, within a period of twelve months from the receipt of the notification, and through the intermediary of the International Bureau of Berne, transmit its possible objections to any other country concerned.

For State emblems which are well known, the provisions of paragraph 1 shall only be applicable to marks registered after the signature of this Convention.

For State emblems which are not well known, and for official signs and stamps, these provisions shall only be applicable to marks registered more than two months after the notification provided for in paragraph 3.

In the case of dishonesty, countries shall have the right to cancel even the marks registered before the signature of the present Convention and embodying State emblems, signs and stamps.

Nationals of each country who are authorized to make use of State emblems, and signs and stamps of their country, may use them even if there be a similarity with those of another country.

The contracting countries undertake to prohibit the unauthorized use in trade of State Coats of Arms of other contracting countries when such use would be liable to cause confusion as to the origin of the product.

The preceding provisions will not prevent the countries exercising the right to refuse or to invalidate by the application of number 3 of paragraph 2 of Article 6, marks containing without authority Coats of Arms flags, decorations, and other State emblems or official signs and stamps adopted by a country of the Union.

Article 7

The nature of the goods on which the trade mark is to

A report of U. S. Commissioner of Patents Robertson says that material relief from former onerous conditions affecting American patent rights in foreign countries has been secured. While the conference did not go so far in the matter of working patents and in the taxes thereon as desired, the present convention represents a long step forward and very materially dimishes the risk of a patentee losing his rights as in former years

be used can, in no case, form an obstacle to the *registration of the trade mark.*

Article 7 Bis

The contracting countries undertake to allow the filing of, and to protect, trade marks belonging to associations, the existence of which is not contrary to the law of the country of origin, even if such associations do not possess an industrial or commercial establishment.

Nevertheless, each country shall be the sole judge of the particular conditions on which an association may be allowed to obtain protection for its marks.

Article 8

A trade name shall be protected in all countries of the Union without the obligation of filing or registration, whether it form part or not of a trade mark.

Article 9

All goods illegally bearing a trade mark or trade name shall be seized on importation into those countries of the Union where this mark or name has a right to legal protection.

Seizure shall be effected equally in the country where the mark or name was illegally applied, or in the country to which the article bearing it has been imported.

The seizure shall take place either at the request of the proper Government department or of any other competent authority, or of any interested party, *or actual or legal person,* in conformity with the domestic law of each country.

The authorities are not bound to effect the seizure in transit.

If the law of a country does not admit of seizure on importation, such seizure shall be replaced by prohibition of importation or *seizure within such country.*

If the law of any country does not admit either of seizure upon importation, or of prohibition of importation, *or of seizure within the country, and until such time as this legislation shall be accordingly modified,* these measures will be replaced by the remedies assured in such cases to nationals by the law of such country.

Article 10

The stipulations of the preceding Article shall be applicable to every production which may falsely bear as indication of origin the name of a specified locality *or country* when such indication shall be joined to a trade name of a fictitious character or used with intent to defraud.

Any producer, manufacturer, or trader, engaged in the production, manufacture, or trade, of such goods, and established either in the locality falsely designated as the place of origin, or in the district where the locality is situated, *or in the country falsely designated* shall be deemed *in all cases* a party concerned, *whether such person be actual or legal.*

Article 10 Bis

The contracting countries are *bound* to assure to *nationals of the Union* an effective protection against unfair competition.

Every act of competition contrary to honest practice in industrial or commercial matters constitutes an act of unfair competition.

The following particularly are to be forbidden:

1. *all acts whatsoever of a nature to create confusion, by no matter what means, with the goods of a competitor;*
2. *false allegations, in the course of trade, of a nature to discredit the goods of a competitor.*

Article 10 Ter

The contracting countries undertake to assure to the nationals of other countries of the Union appropriate legal remedies to repress effectively all acts set forth in Articles 9, 10 and 10 bis.

They undertake, moreover, to provide measures to permit syndicates and associations representing the industry of the trade interested, and of which the existence is not contrary to the laws of their country, to take action in justice or before the administrative authorities in view of the repression of the acts set forth in Articles 9, 10 and *10 bis, so far as the law of the country in which protection is claimed permits it to the syndicates and associations of that country.*

Article 11

The contracting countries shall, in conformity with the legislation of each country, accord temporary protection to patentable inventions, to utility models, and to industrial designs or models, as well as to trade marks, in respect of products which shall be exhibited at official, or officially-recognized, international exhibitions held in the territory of one of them.

This temporary protection shall not prolong the periods provided by Article 4. If, later, the right of priority is sought, the competent authority of each country may date the period from the date of the introduction of the product into the exhibition.

Each country may require, as proof of the identity of the object exhibited, and of the date of the introduction, such proofs as it may consider necessary.

Article 12

Each of the contracting countries agrees to establish a special Government department for industrial property, and a central office for communication to the public of patents, utility models, industrial designs or models, and trade marks.

This department shall publish an official periodical paper.

Article 13

The International Office, established at Berne under the name "Bureau International pour la Protection de la Propriété Industrielle," is placed under the high authority of the Government of the Swiss Confederation which is to regulate its organization and supervise its working.

The official language of the International Bureau *is* French.

The International Office centralizes information of every kind relating to the protection of industrial property and *collates and publishes it.* It *interests* itself in all matters of common utility to the Union, and *edits,* with the help of the documents supplied to it by the various Administrations, a periodical paper in the French language, dealing with questions regarding the object of the Union.

The numbers of this paper, as well as all the documents published by the International Office, *are* circulated among the Administrations of the countries of the Union in the proportion of the number of contributing units as mentioned below. Such further copies as may be desired, either by the said Administrations, or by societies or private persons, will be paid for separately.

The International Office shall at all times hold itself at the service of members of the Union, in order to supply them with any special information they may need on questions relating to the international system of industrial property. *The Director of the International Bureau* will furnish an annual report on its working, which shall be communicated to all members of the Union.

The expenses of the International Bureau will be borne by the contracting countries in common. *Unless fresh sanction is given,* they must *not* exceed the sum of *120,000 Swiss francs per annum. This sum may be increased in case of necessity by a unanimous decision of one of the conferences provided for by Article 14.*

To determine the part which each country should contribute to this total of expenses, the contracting countries, and those which may afterwards join the Union, shall be divided into six classes, each contributing in the proportion of a certain number of units, namely:

	Units
1st class	25
2nd class	20
3rd class	15
4th class	10
5th class	5
6th class	3

These co-efficients will be multiplied by the number of countries in each class, and the sum of the result thus obtained will supply the number of units by which the total expense has to be divided.

The quotient will give the amount of the unit of expense.

Each of the contracting countries will designate at the time of its accession the class in which it wishes to be placed.

The Government of the Swiss Confederation *is to superintend* the expenses of the International Bureau, advance the necessary funds, and render an annual account, which will be communicated to all the other Administrations.

Article 14

The present Convention shall be submitted to periodical revisions with a view to the introduction of amendments calculated to improve the system of the Union.

For this purpose, Conferences shall be held successively, in one of the contracting countries, between the delegates of the said countries.

The Administration of the country in which the Conference is to be held will make preparation for the transaction of that Conference, with the assistance of the International Bureau.

The Director of the International Bureau will be present at the meetings of the Conferences and will take part in the discussions, but without the privilege of voting.

Article 15

It is agreed that the contracting countries respectively reserve to themselves the right to make separately, as between themselves, special arrangements for the protection of industrial property, in so far as such arrangements do not contravene the provisions of the present Convention.

Article 16

Countries which are not parties to the present Convention shall be allowed to accede on their request.

The accession shall be notified through the diplomatic channel to the Government of the Swiss Confederation, and by the latter to all the other countries.

It shall entail, as a matter of right, accession to all the clauses, as well as admission to all the advantages stipulated in the present Convention, and shall take effect one month after the dispatch of the notification by the Government of the Swiss Confederation to the other countries of the Union, unless a subsequent date has been indicated by the acceding country.

Article 16 Bis

The contracting countries have the right of acceding to the present Convention at any time on behalf of their Colonies, Possessions, Dependencies, and Protectorates, *or territories administered by virtue of a mandate from the League of Nations,* or of any of them.

For this purpose they may either make a general declaration, including all their Colonies, Possessions, Dependencies, and Protectorates, *and the Territories referred to in paragraph 1,* in the accession, or may expressly name those included, or may confine themselves to indicating those which are excluded therefrom.

This declaration shall be notified in writing to the Government of the Swiss Confederation and by the latter to all the other countries.

Under the same conditions, the contracting countries may denounce the Convention on behalf of their Colonies, Possessions, Dependencies, and Protectorates, *or for the territories referred to in paragraph 1,* or of any of them.

Article 17

The execution of the reciprocal engagements contained in the present Convention is subordinated, in so far as necessary, to the observance of the formalities and rules established by the constitutional laws of those of the contracting countries who are bound to procure the application of the same, which they engage to do with as little delay as possible.

Article 17 Bis

The Convention shall remain in force for an unlimited time, till the expiry of one year from the date of its denunciation.

This denunciation shall be addressed to the Government of the Swiss Confederation. It shall only affect the denouncing country, the Convention remaining in operation as regards the other contracting countries.

Article 18

The present Act shall be ratified and the ratifications deposited at *The Hague* not later than the *1st May, 1928.* It shall come into force, as between the countries which *will have ratified it,* one month after *such date.*

Nevertheless, if before 1st May, 1928, it should be ratified by at least six countries, it will come into force between those countries one month after the Government of the Swiss Confederation has notified them of the filing of the sixth ratification, and for the countries who should subsequently ratify, one month after the notification of each of these ratifications.

This Act shall replace, as regards relations between the countries which ratify it: the Union Convention of Paris, 1883, *revised at Washington June 2nd, 1911, and its Final Protocol,* which shall remain in force as regards relations with countries which have not ratified the present Act.

Article 19

The present Act shall be signed in a single copy, which shall be deposited in the archives of the Government of the *Netherlands*. A copy, certified as correct, shall be forwarded by the latter to each of the Governments of the *contracting countries*.

In witness whereof the respective Plenipotentiaries have signed the present Act.

Done at *The Hague*, in a single copy, the *6th November, 1925*.

Co-operation in the Elimination of Waste

By George Hodge
Assistant Manager, Industrial Relations, International Harvester Co.

THE factories and operations of the International Harvester Co. cover a wide range of production, including iron, steel, lumber, coal, coke, coal tar by-products, sisal fiber, binder twine, etc., that require the employment of men in almost all of the major mechanical crafts. While some of the newer factories were built on a scientific basis, with a view to mass production, and with a view also to continuing expansion without reconstruction or drastic re-arrangement, most of these plants have grown up slowly from small beginnings. As a result, these factories furnish a competent cross section of productive industry.

Results from the New System

Seven years ago safety through industrial co-operation began for our company. That was when we offered to the employees our system of industrial relations built around the works councils. For the eleven years previous we had concentrated on mechanical safeguarding, and on a system of rules and discipline with careful and continuous inspection. The results were good, but not good enough. Then came the new safety representation through the works councils with effort toward co-operation with the management in accident prevention.

In my own opinion, this co-operation could never have been obtained without the works councils, and without the spirit and atmosphere of mutual understanding and mutual interest that they have created between our company and its employees. During the period from 1908 to 1923, a 75 per cent improvement was accomplished in lost time cases due to accidents. In 1924, under the co-operative councils, there was a 12 per cent improvement over 1923, and in 1925 another 12 per cent improvement over 1924. One of our works in 1923 ranked fourteenth in our inter-plant safety contest. At the meeting of the works council of this plant in December, 1923, it was decided to eliminate accidents, and to win the company's safety banner for 1924. Through the co-operation of the works council the year 1924 was completed without a single lost time accident!

Statistics show that out of every 100,000 blind persons in the United States, 15,000 lost their sight through industrial accidents. Employee co-operation in wearing goggles on designated jobs has made it possible for us in the Harvester Company now to count eyes saved rather than eyes lost. We point to a record of 185 eyes saved during the last three years!

Even in the most favored industrial groups, time lost on account of sickness is not less than five days per year per man. The average is probably seven or eight days. When we compare this figure with the average of less than one day lost per man on account of injury, we see the relative importance of these two problems. Too frequently we see men who are invaluable because of service, experience, and ability, quitting industry because of chronic diseases. Such loss to industry is unfortunate when we know that periodical physical examinations furnish the means of discovering many chronic diseases before disabling symptoms appear.

The highest possible efficiency will not be attainable when the operator who is running a machine is not a satisfied man, a man who not only comprehends clearly what he is doing, but also has a clear vision of why he is doing that particular thing in that particular way. Recently in making a trip through one of our plants, the superintendent noticed a red-tagged casting on the bench of an employee. Answering the superintendent's inquiry, the workman said that his employee-representative had lent it to him and also had procured for him the part to which his product must match. By trying a piece now and then, he said, he had things fixed so that no more spoiled work would come from his bench.

Management can prescribe just how far from perfect a piece may be before it must be rejected, but the best inspection of tolerances does not equal the work of the man who realizes the why of the tolerances fixed for him, and lives up to that realization. One of our plants now invites and urges employees to study the completed product set up on the display floor of the factory. Here they can see the finished product, and can note the function of the particular parts they produce.

Ideas Need Backing

Another waste is that of constructive ideas that "die" before they can reach administrative attention, or the waste of undeveloped or undirected thoughts in which the seeds of progress exist but never germinate. The general public may believe that the inventions which make possible the progress of American industry come chiefly from the intuitive genius of this or that inventor's brain. We know, however, that the most that the average inventor discovers is an idea, and that it takes engineering ability, with a laboratory and a workshop, and a man or a company with money, and then frequently years of time and toil, to convert that idea into something practical and commercially profitable.

In our company, which always has an open ear and mind for anybody who thinks he has an idea of value to our kind of production, ninety per cent of the improvements we have put into use have been devised and invented by men in our employ; that is, these inventions were produced by putting men with an inventive turn of mind into workshops or laboratories where they could have the time, the materials, and the equipment to experiment with a specific problem of the business. In conclusion, it seems to me that industrial co-operation on a basis of mutual understanding, respect, and confidence offers a factor in the reduction of industrial waste that cannot be ignored.

Astract from a paper presented at the meeting of the Chicago Section, A.S.M.E., March 24, 1926.

Men who quit a job because they can't get along with the boss seldom get along in a business of their own.

Automotive Production

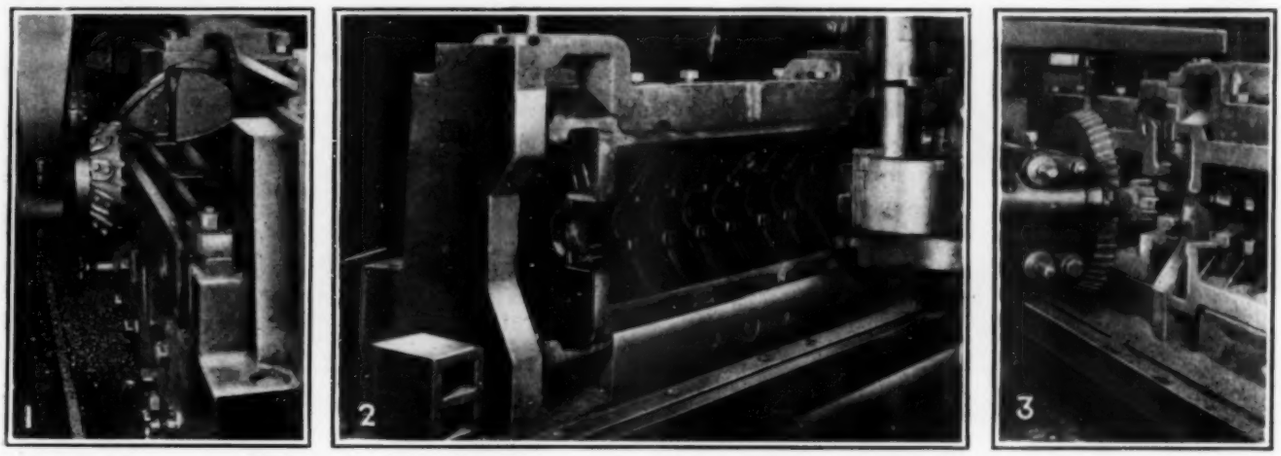


Fig. 1—Milling cylinder tops. Fig. 2—Opposite end of same cylinder
Fig. 3—Finishing face and bearing cap seats

Stutz Milling and Boring Fixtures

By Fred H. Colvin
Editor, *American Machinist*

Methods used in machining the new Stutz eight-in-line cylinder block — Drilling oil holes 36 in. deep — Trunnion and indexing fixtures

THE advent of the eight-in-line engine has brought new problems to production engineers, and has necessitated new ideas in tools and fixtures. This condition is particularly true in factories where the production is not large, as we know automobile manufacture today, which makes the solutions worked out all the more significant.

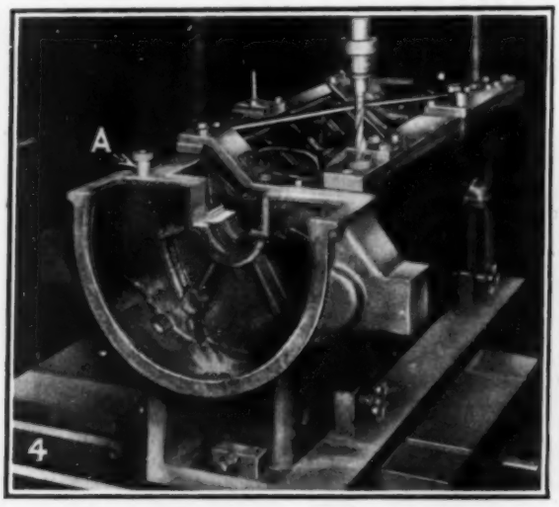
The interest shown in the new Stutz car at the recent Automobile Shows, makes the showing of the methods used in building it, of particular moment at this time. And while some of the methods will probably change as manufacturing progresses, both the way in which present equipment has been utilized and the design of the fixtures used, are well worth careful consideration. For, although these methods are entirely related to the production of automobile engines, many of them can be applied equally well to the making of a dozen other types of machines, in the average shop.

The cylinder blocks are first normalized by heating to from 900 to 1,000 deg. F. Then they are sprayed inside with a sealing liquid, and primed on the outside. Several milling operations are performed at one setting, by separate cutter heads on an Ingersoll milling machine. These operations are shown in Figs. 1, 2 and 3, which also give a general idea of the design of the fixtures. The top is being milled in Fig. 1, and the oil-pan joint surface and bearing-cap seats are being rough surfaced in Fig. 2. On the other side of the housing, these surfaces are being finished. Next comes the drilling of the locating holes, Fig. 4, the jig being located on the lower-case surface and on the bearing-cap seats. A loose bushing is shown at *A*. After the core holes have been counterbored and plugged, the block goes to the Moline boring machine, Fig. 5, the supporting bracket and the locating plugs being clearly shown.

The drilling line is shown in Fig. 6, the American radial in the foreground being in reality at the end of the line, and taking care of holes that could not well be handled by the four multiple-spindle machines. The block is drilled on various sides in the trunnion fixture and travels from one machine to the next.

Another double-operation milling machine is shown in Figs. 7 and 8. The first shows the milling of both

Automotive Production



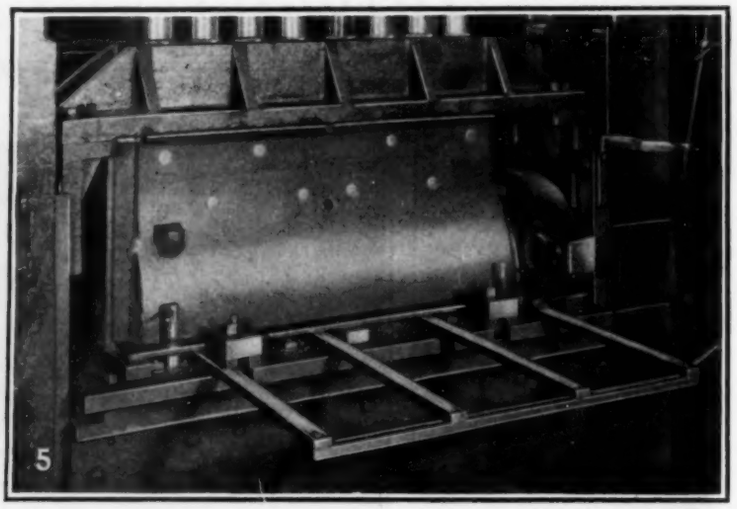


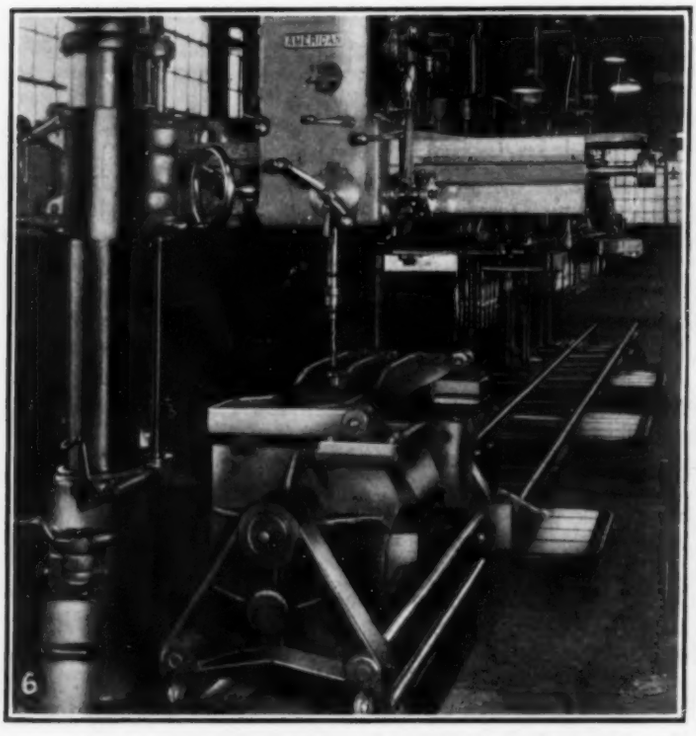
Fig. 4—Drilling the locating holes. Fig. 5—Boring eight cylinders at once

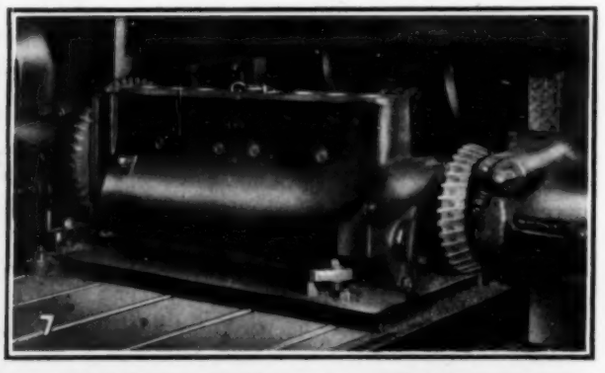
ends, while the second shows how the ends of all the bearing supports are faced by a gang of straddle mills. Fig. 8 shows both sets of cutters, the block being held against the back face of the fixture *A*. The two sets of cutters revolve in opposite directions so as to have the cutter thrust down on both operations.

The end holes are drilled under the multiple machine in Fig. 9. The fixture is double and holds two blocks at once, but with opposite ends up, so that both ends are drilled at once. The blocks are located by the dowels and are easily clamped.

There are no oil pipes in the new Stutz engine, all oil passages being drilled through the solid metal of the block itself. The main oil-hole is drilled from each end on a special, double-headed machine made by the W. F. & John Barnes Co., and equipped with an Oil Gear feed, as in Fig. 10. The hole is $\frac{11}{16}$ in. in diameter and 36 in. deep. It is drilled from both ends, each head having its own motor. The heads feed in automatically and when the drills nearly meet, one head withdraws to allow the drill in the other one to break through.

Next in line is a 5-spindle boring machine, Fig. 11, equipped with a double indexing fixture so that the second block can be put in place and the boring bars put





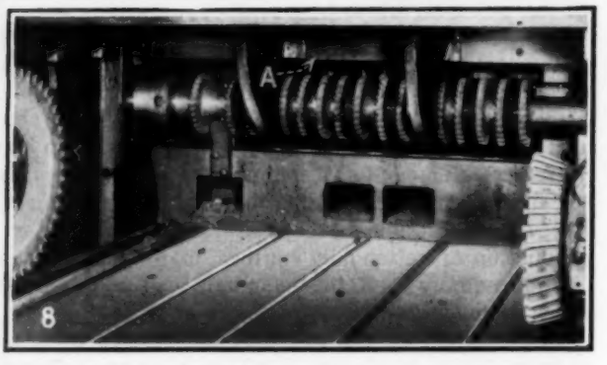
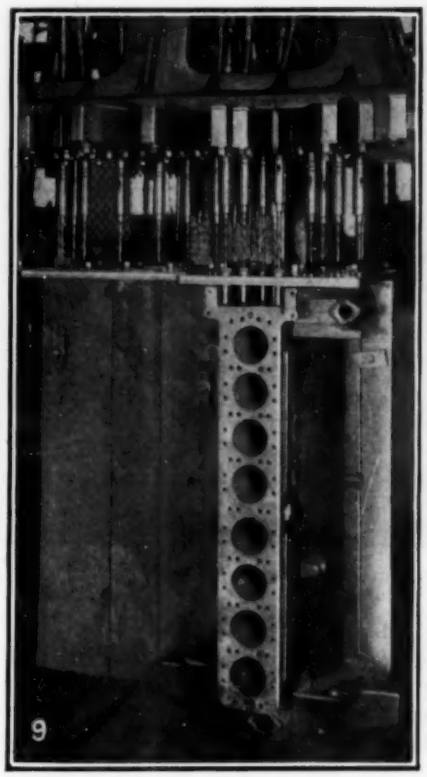
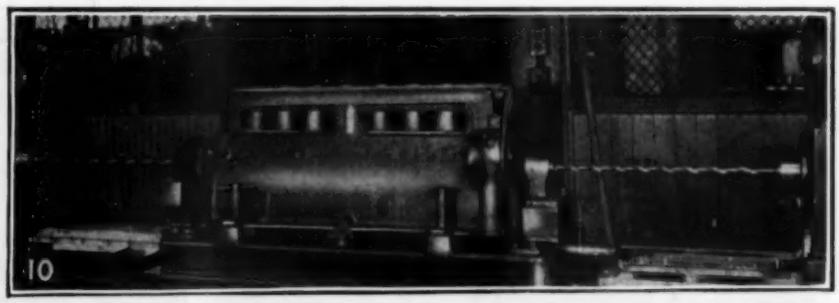


Fig. 6—The cylinder block drilling line. Fig. 7—Milling the ends
Fig. 8—Second operation on same machine

Automotive Production





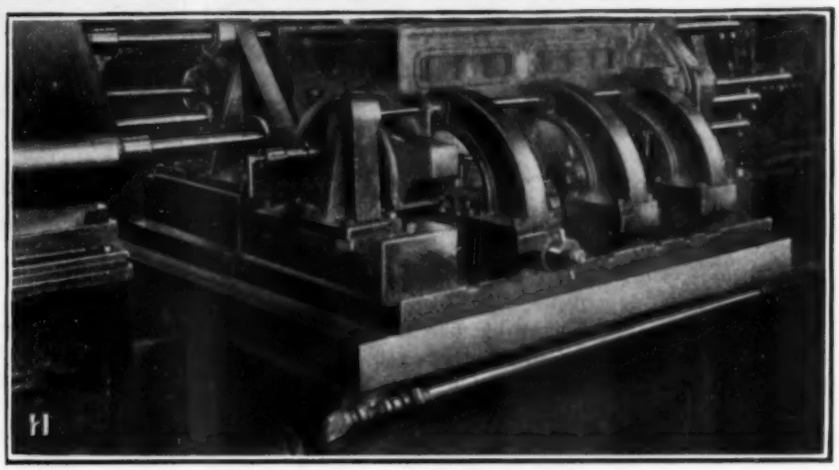
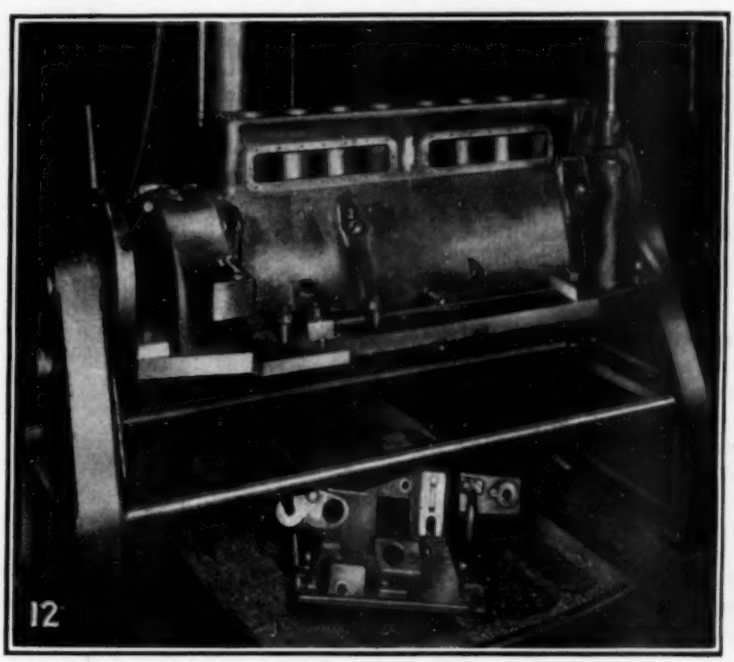


Fig. 9—Drilling both ends at one set-up. Fig. 10—Drilling oil passage in solid iron
Fig. 11—Line-boring five holes at one setting

in position, ready to swing into line with the driving spindle as soon as the first block has been bored. No time is lost in removing the boring bars, it being only necessary to slip the driving clutch over the end and start the bars at work. Fig. 11 also shows how well the bars are supported. The size and rigidity of this fixture secures excellent alignment of all the holes.

A number of miscellaneous drilling and reaming operations are done on the American radial, Fig. 12, using the trunnion fixture shown. Plates carrying drill bush-



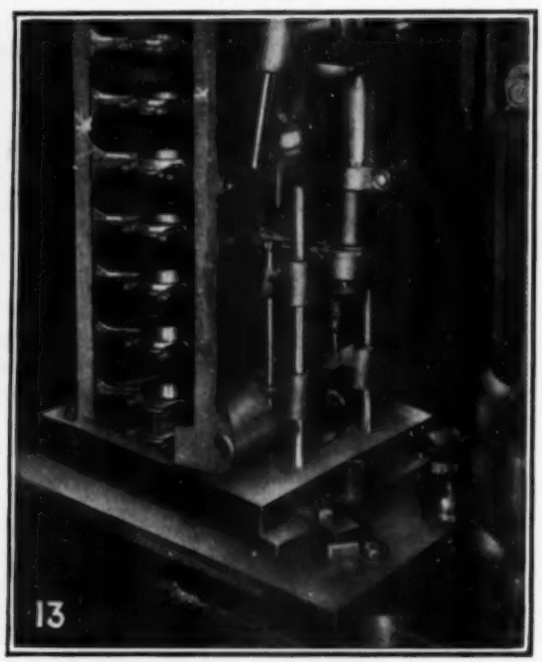
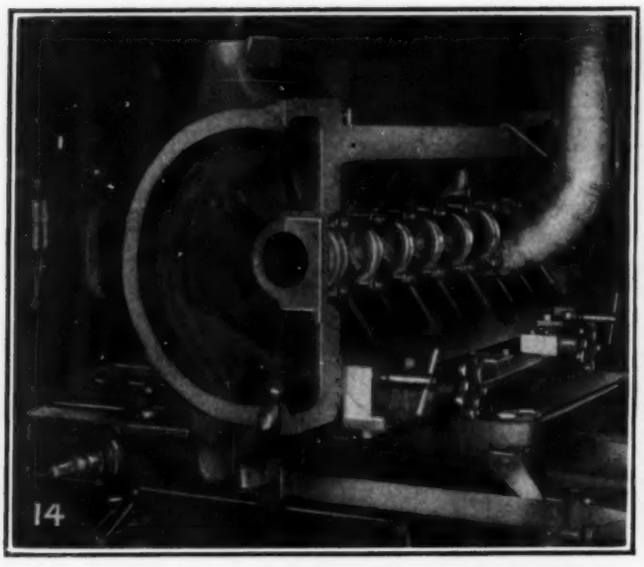


Fig. 12—Trunnion jig under radial. Fig. 13—Special 3-spindle head at worl.

Automotive Production



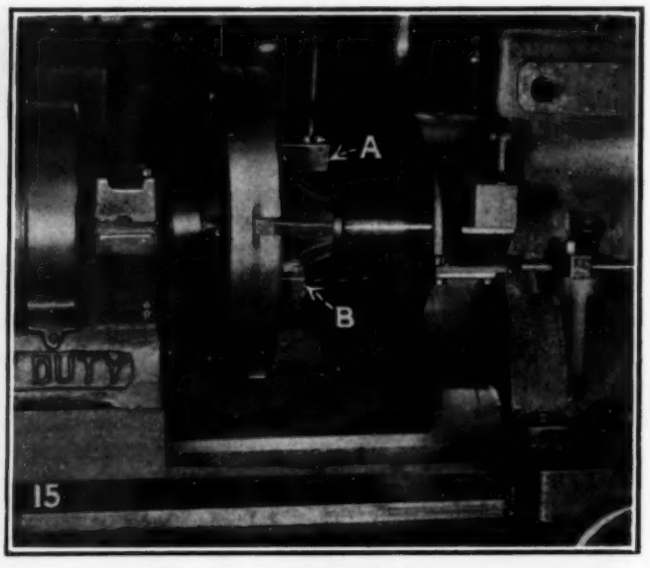


Fig. 14—Grinding cylinder bores. Fig. 15—Final boring and facing of bell-housing

ings and locking clamps are used to drill various holes that cannot be easily handled in a box fixture. One of these plates is shown on the table.

Another special drilling operation is shown in Fig. 13, with a Hoeffer 3-spindle head on a vertical drilling machine spindle run down to the table. The head and fixture are built together, and guided by the uprights shown.

Grinding is still in vogue in the Stutz shop, Fig. 14, showing a cylinder block in position on a Heald machine, fitted with an exhaust system.

As a final operation on the cylinder block, the bell-housing end is bored and faced after the lower part of the housing has been bolted in place. The central arbor fits the crankshaft hole and the cutters in arms *A* and *B* bore and face the end for the clutch unit. This operation is done on an old LeBlond lathe using a fixture on the lathe carriage.

Higher Buffing Speeds on 25- and 60-Cycle Current

By Matt J. Herold
The United States Electrical Tool Co.

WE HAVE been watching the articles in the *American Machinist* on the subject of polishing methods, and they recall our experiences with several manufacturing companies, who requested certain speeds for polishing work.

With 25-cycle current, we are only able to secure two synchronous speeds, namely, 750 and 1,500 r.p.m. But by means of frequency converters using 25-cycle current, we can secure the following frequencies and speeds: 30 cycles, 1,800 r.p.m.; 35 cycles, 2,200 r.p.m.; 40 cycles, 2,400 r.p.m.; 45 cycles, 2,700 r.p.m.; 50 cycles, 3,000 r.p.m. Similarly, using a frequency changer with 60-cycle current, we can secure frequencies and speeds of 80 cycles, 2,323 r.p.m., and 90 cycles, 2,625 r.p.m.

In the woodworking industry, the frequency converter has gained wide use. By means of 120-cycle current, one manufacturer has tripled production without changing the plant layout. In the plating and polishing industries, engineers are commencing to use odd frequencies to obtain more productive and economic results. Direct driven polishing lathes are built to operate on 25-cycle current at approximately 1,500 r.p.m., and on 60-cycle at about 1,800 or 3,600 r.p.m. For polishing, a speed of 2,200 r.p.m. is considered ideal; for buffing, 2,600 to 2,700 r.p.m., both using wheels approximately 14 in. in diameter. These intermediate speeds are easily secured by properly designed frequency converters.

In the Niagara Falls district, a large manufacturer has only 25-cycle current at his disposal, and secured a speed of 2,200 r.p.m. full load, by designing a special converter. The frequency converter employed is made up of two motors, the first of 50 hp., 220 volts, 25 cycles, with rated speed of 750 r.p.m. The other was a 25-hp., 220-volt, 25-cycle, slip-ring motor with rated speed of 1,500 r.p.m., direct-connected to the first motor. The stator winding of the 25-hp. motor was connected with a 3-pole fused switch to the main line. The slip-ring connection was run directly through fused cutouts to the polishing jacks.

The frequency set is started with care being taken that the switch on the 25-hp. motor is left open until the normal speed is obtained. A full-load speed of 2,200 r.p.m. is obtained. However, speeds up to 2,700, which are proper for this class of work, can be obtained by proper design of the frequency converters.

The frequency converter unit described is supplying power to a group of seventeen 5-hp. pedestal-type polishers, and has been in operation more than two years. Another plant in the Middle West is operating 150, 7½ and 10-hp. buffing lathes with 60-cycle current available. Frequencies of 80 cycles are supplied for polishing, and 90 cycles for buffing. Production was increased 25 per cent, and better results were obtained, because of more consistant speed of the wheels than with belt driven units, without increasing power consumption.

The Design of Gear Tooth Forms

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Nomenclature and definitions of gear teeth—The 14½-deg. composite system of gear teeth with tabulated formulas for their proportions

BEFORE discussing in detail any of the standard gear tooth systems, or the considerations that led to their adoption, we will first define several of the terms which are commonly used:

Gear Tooth Parts

Addendum: The addendum of a gear tooth is the height of the gear tooth outside of the pitch circle.

Dedendum: The dedendum is the depth of the tooth space below the pitch circle.

Active Profile: The active profile is that part of the gear tooth profile which actually comes in contact with the profile of its mating tooth along the line of action.

Angle of Action: The angle of action is the angle through which one tooth travels from the time it first makes contact with its mating tooth on the line of action until it ceases to be in contact.

Base Circle: The base circle of an involute is the circle from which a line would be unwrapped to develop the involute curve.

Center Distance: The center distance is the distance between the centers of a pair of mating gears.

Circular Pitch: The circular pitch is the length of an arc of the pitch circle that corresponds to one tooth interval. It is equal to the circumference of the pitch circle divided by the number of teeth in the gear.

Clearance: The clearance is the space provided between the top of the tooth of one gear and the bottom of its mating tooth space.

Diametral Pitch: The diametral pitch is the ratio of the number of teeth to the pitch diameter of a gear. It represents the number of teeth per inch of pitch diameter. For example, if a gear of 2-in. pitch diameter has 12 teeth, its diametral pitch is equal to $\frac{12}{2}$, or 6.

Interference: Interference relates to the existence of conditions that permit contact between mating teeth away from the line of action. Such conditions interfere with the transmission of uniform motion.

Line of Action: The line of action is the line along which correct contact between mating teeth is made which results in the transmission of uniform motion from one gear to the other.

Module: The module is the ratio of the pitch diameter of a gear with its number of teeth. It is the reciprocal of the diametral pitch. It represents the pitch diameter of a gear per tooth. For example, the module of a gear of 2-in. pitch diameter with 16 teeth would be $\frac{2}{16}$, or 0.125. The module multiplied by the number of teeth equals the pitch diameter.

Normal Pitch: The normal pitch of an involute gear is the distance between two successive parallel involutes that form the profiles of two adjacent teeth. It is equal to the circumference of the base circle divided by the number of teeth in the gear.

Pitch Circle: The pitch circle is the circle that represents a smooth disk that would transmit by friction the desired relative motion.

Pressure Angle: The pressure angle of a pair of involute gears is the angle between the line of action and a line perpendicular to the common centerline of the two mating gears.

Whole Depth: The whole depth is the total depth of the space on a gear measured radially between circles containing the tops of the teeth and the bottoms of the spaces.

Working Depth: The working depth is the depth that the teeth of one gear extend into the spaces of its mating gear. It is equal to the sum of the addenda of mating gears. It is also equal to the whole depth minus the clearance.

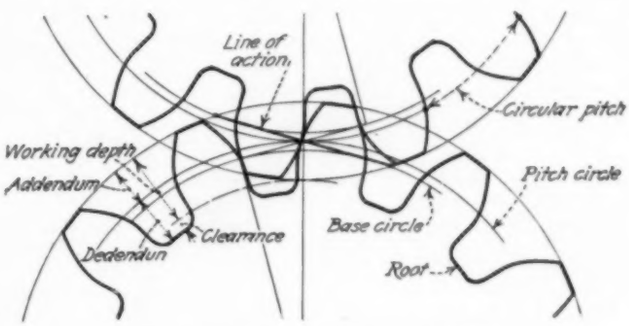


Fig. 39—Gear tooth nomenclature

Several of the foregoing terms are illustrated in Fig. 39.

Many factors are involved in the design of gear teeth. Here, as with all other engineering problems, the full advantage of one feature can seldom be taken without losing some of the advantages of other factors. The relative importance of the several factors must be weighed, and the final result is a compromise between the conflicting elements. As time goes on and as conditions change, the relative importance of different factors may also change so that the compromise that was best for one set of conditions will be no longer justifiable for the new and changed conditions such as we face at the present time.

The primary purpose of gears is to transmit uniform motion. The first essential to attain this end is tooth

The ninth article. The tenth will appear in an early issue.

profiles of conjugate form. Also, these profiles must be long enough so that the action is continuous; that is, the second pair of mating teeth must come in contact before the first pair have ceased to be in contact. In other words, the angle of action must be greater than the angle between successive teeth.

One word of caution at the outset: *No improvement in form alone will outweigh the importance of careful and painstaking workmanship in the production of the gears themselves.* In addition, the design of the mechanism in which the gears are used must provide a sufficiently rigid support to hold the gears in proper alignment under their working loads.

The Introduction of Cut Gears

The cut tooth gear is a comparatively modern achievement. Most of the earlier gear teeth were cast to form. These forms were shaped by the pattern maker to a more or less close approach to conjugate form. At the time when machining the gear teeth to form began to gain in favor, two forms were advocated, the cycloid and the involute. The cycloid is a more sensitive form. It requires accurate center distances to operate properly and also requires a larger series of form cutters to cover a given range than the involute does, and so it rapidly lost favor among designers.

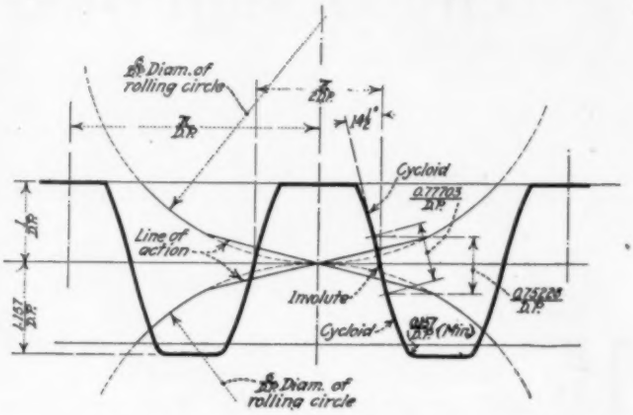


Fig. 40—Basic rack for the 14½-deg. composite system of gear teeth

Table II—Formulas for 14½-deg. Composite Gears

DP = diametral pitch
CP = circular pitch
N = number of teeth in gear
D = outside diameter
D' = pitch diameter
s = addendum and also length of working face below the pitch line
$2s = D''$ = working depth of tooth
f = clearance
$s + f$ = dedendum
$D'' + f$ = whole depth
t = thickness of tooth on pitch line
C = center distance

Having	To Get	Rule	Formula
Diametral pitch	Circular pitch	Divide 3.1416 by the diametral pitch	$CP = 3.1416/DP$
Pitch diameter and number of teeth	Circular pitch	Divide pitch diameter by the product of 0.3183 and number of teeth	$CP = D'/0.3183N$
Outside diameter and number of teeth	Circular pitch	Divide outside diameter by the product of 0.3183 and number of teeth plus two	$CP = D/0.3183\ (N+2)$
Number of teeth and circular pitch	Pitch diameter	The continued product of the number of teeth, the circular pitch, and 0.3183	$D'=0.3183N\times CP$
Number of teeth and outside diameter	Pitch diameter	Divide the product of number of teeth and outside diameter by number of teeth plus two	$D'= N\times D/(N+2)$
Number of teeth and diametral pitch	Pitch diameter	Divide the number of teeth by the diametral pitch	$D' = N/DP$
Number of teeth and circular pitch	Outside diameter	The continued product of the number of teeth plus two, the circular pitch, and 0 3183	$D=(N+2)\times 0.3183\times CP$
Number of teeth and diametral pitch	Outside diameter	Divide the number of teeth plus two by the diametral pitch	$D=(N+2)/DP$
Pitch diameter and diametral pitch	Outside diameter	Add two divided by the diametral pitch to the pitch diameter	$D=D'+2/DP$
Pitch diameter and circular pitch	Number of teeth	Divide the product of pitch diameter and 3 1416 by the circular pitch	$N=3.1416D'/CP$
Pitch diameter and diametral pitch	Number of teeth	Product of pitch diameter and dimetral pitch	$N=D'\times DP$
Circular pitch	Thickness of tooth	One-half the circular pitch	$t=CP/2$
Diametral pitch	Thickness of tooth	Divide 1.5708 by the diametral pitch	$t=1.5708/DP$
Circular pitch	Addendum	Multiply the circular pitch by 0.3183	$s=0.3183CP$
Diametral pitch	Addendum	Divide one by the diametral pitch	$s=1/DP$
Circular pitch	Dedendum	Multiply the circular pitch by 0.3683	$s+f=0.3683CP$
Diametral pitch	Dedendum	Divide 1.157 by the diametral pitch	$s+f=1.157/DP$
Circular pitch	Working depth	Multiply the circular pitch by 0.6366	$D''=0.6366CP$
Diametral pitch	Working depth	Divide 2 by the diametral pitch	$D''=2/DP$
Circular pitch	Whole depth	Multiply the circular pitch by 0.6866	$D''+f=0.6866CP$
Diametral pitch	Whole depth	Divide 2.157 by the diametral pitch	$D''+f=2.157/DP$
Circular pitch	Clearance	Multiply the circular pitch by 0.05	$f=0.05CP$
Diametral pitch	Clearance	Divide 0.157 by the diametral pitch	$f=0.157/DP$
Circular pitch	Diametral pitch	Divide 3.1416 by the circular pitch	$DP=3.1416/CP$
Pitch diameter and number of teeth	Diametral pitch	Divide number of teeth by the pitch diameter	$DP= N/D'$
Outside diameter and number of teeth	Diametral pitch	Divide number of teeth plus 2 by outside diameter	$DP=(N+2)/D$

Note: Table of formulas adapted from the *American Machinist's Handbook.*
The center distance between any pair of these gears is found by adding together one-half of the pitch diameter of both gears

Table III—Tooth Parts of 14½-deg. Composite Gear Tooth System

Diametral Pitch	Circular Pitch	Thickness of Tooth on Pitch Line	Addendum	Working Depth of Tooth	Depth of Space Below Pitch Line	Whole Depth of Tooth
½	6.2832	3.1416	2.0000	4.0000	2.3142	4.3142
¾	4.1888	2.0944	1.3333	2.6667	1.5428	2.8761
1	3.1416	1.5708	1.0000	2.0000	1.1571	2.1571
1¼	2.5133	1.2566	0.8000	1.6000	0.9257	1.7257
1½	2.0944	1.0472	0.6667	1.3333	0.7714	1.4381
1¾	1.7952	0.8976	0.5714	1.1429	0.6612	1.2326
2	1.5708	0.7854	0.5000	1.0000	0.5785	1.0785
2½	1.3963	0.6981	0.4444	0.8889	0.5143	0.9587
2½	1.2566	0.6283	0.4000	0.8000	0.4628	0.8628
2¾	1.1424	0.5712	0.3636	0.7273	0.4208	0.7844
3	1.0472	0.5236	0.3333	0.6667	0.3857	0.7190
3½	0.8976	0.4488	0.2857	0.5714	0.3306	0.6163
4	0.7854	0.3927	0.2500	0.5000	0.2893	0.5393
5	0.6283	0.3142	0.2000	0.4000	0.2314	0.4314
6	0.5236	0.2618	0.1667	0.3333	0.1928	0.3595
7	0.4488	0.2244	0.1429	0.2857	0.1653	0.3081
8	0.3927	0.1963	0.1250	0.2500	0.1446	0.2696
9	0.3491	0.1745	0.1111	0.2222	0.1286	0.2397
10	0.3142	0.1571	0.1000	0.1818	0.1157	0.2157
12	0.2618	0.1309	0.0833	0.1667	0.0964	0.1798
14	0.2244	0.1122	0.0714	0.1429	0.0826	0.1541
16	0.1963	0.0982	0.0625	0.1250	0.0723	0.1348
18	0.1745	0.0873	0.0556	0.1111	0.0643	0.1198
20	0.1571	0.0785	0.0500	0.1000	0.0579	0.1079
24	0.1309	0.0654	0.0417	0.0833	0.0482	0.0898
28	0.1122	0.0561	0.0357	0.0714	0.0413	0.0770
32	0.0982	0.0491	0.0313	0.0625	0.0362	0.0674
36	0.0873	0.0436	0.0278	0.0556	0.0321	0.0599
40	0.0785	0.0393	0.0250	0.0500	0.0289	0.0539
48	0.0654	0.0327	0.0208	0.0417	0.0241	0.0449

The biggest single step in advance in the early days of gear cutting practice was the introduction of the 14½-deg. composite system. This system has been widely known as the "Standard 14½-deg. Involute System," although but a small part of the profile is of involute form. It is a compromise between the involute and cycloid, and was arrived at when both forms were widely used.

The angle of 14½ deg. was chosen as the pressure angle of the involute portion of this system because its sine was practically equal to ¼ (sin14½ deg. = 0.25038), and it made an easy angle for the millwright or pattern maker to lay out. This angle is a heritage from the cast gear tooth design, but it remains today the most commonly used angle.

The system is a fully interchangeable one; that is, any one gear will run with any other gear of the same pitch, regardless of tooth number, at a center distance which is directly proportional to the numbers of teeth in the gears. The system is based on a pinion of twelve teeth as the smallest of the series and extending up to a rack as the largest of the series of gear sizes.

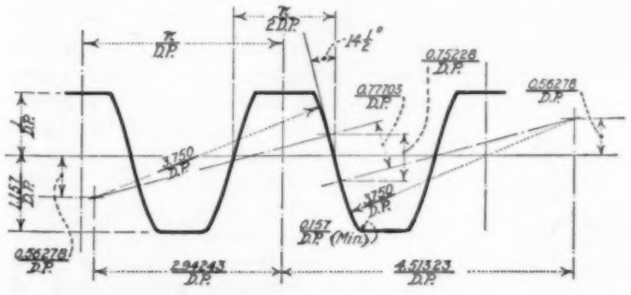


Fig. 41—Cycloidal approximation to the basic rack of the 14½-deg. composite system

As a pinion of twelve teeth of full involute form with a pressure angle of 14½ deg. would be badly undercut, the form is modified from the involute form to a cycloidal one which produces a radial line below the base circle of the twelve-tooth pinion. In order to keep the form of the basic rack of the system symmetrical, which is necessary to maintain an interchangeable system, the form of the addendum of the gears is also modified in the same manner. The result is the basic rack shown in Fig. 40.

The cycloidal form is a very difficult one to produce accurately. A very close approximation to the cycloid shown in Fig. 40 can be made with the arc of a circle as shown in Fig. 41. The modification here is of segmental form and is a theoretically correct profile for the basic rack of a system of interchangeable conjugate gears. This is the basic rack form actually used in practice.

This 14½-deg. composite system has been adopted by the American Gear Manufacturers Association and also by a sectional committee of the American Engineering Standards Committee as a tentative standard. The tooth form has the following proportions:

DP = diametral pitch
M = module, the inverse of the diametral pitch
Addendum = $1/DP = M$
Dedendum = $1.157/DP = 1.157M$
Working depth = $2/DP = 2M$
Whole depth = $2.157/DP = 2.157M$
Clearance = $0.157/DP = 0.157M$.

In Table II formulas are presented that give the general proportions of this system. In Table III the chief dimensions have been calculated for the most commonly used diametral pitches.

Standards for German Machine Tools

Attempts have been made by the German machine tool builders to standardize the direction of movement of all main movable parts of the common types of machine tools, and to eliminate all "freaks" or unusual motions. Direction of slide and screw movements on standard machine tools is being fixed by agreement, and will be adopted by the German manufacturers.

In American machine tool practice, directional movements of the movable parts of machines have been fairly generally standardized by popular acceptance, especially when such directions have had the appearance of "natural" movements. But no general move for complete standardization has apparently ever been made in the United States.

In Figs. 1, 2 and 3 are illustrated the directions of movement as adopted by the German industry for planers, shapers, slotters, and vertical mills. Throughout on the planer it is seen that a right-hand, or clockwise, movement of the operating wheel or screw is designed to move the head and cross rail in or down, so that in general the tool meets the work with this movement.

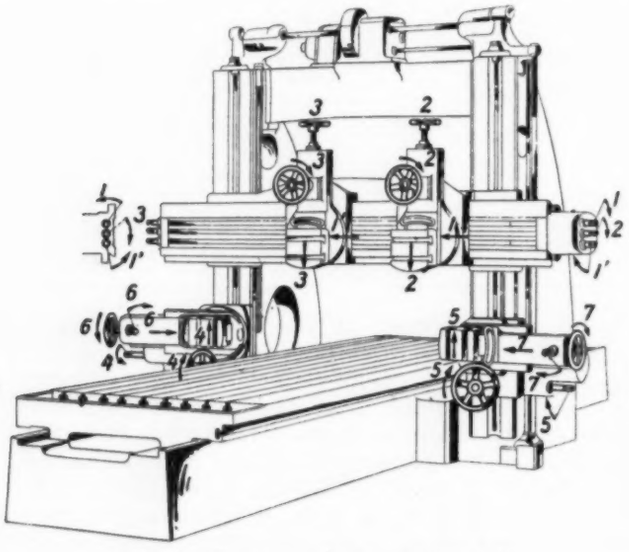


Fig. 1—German planer movements

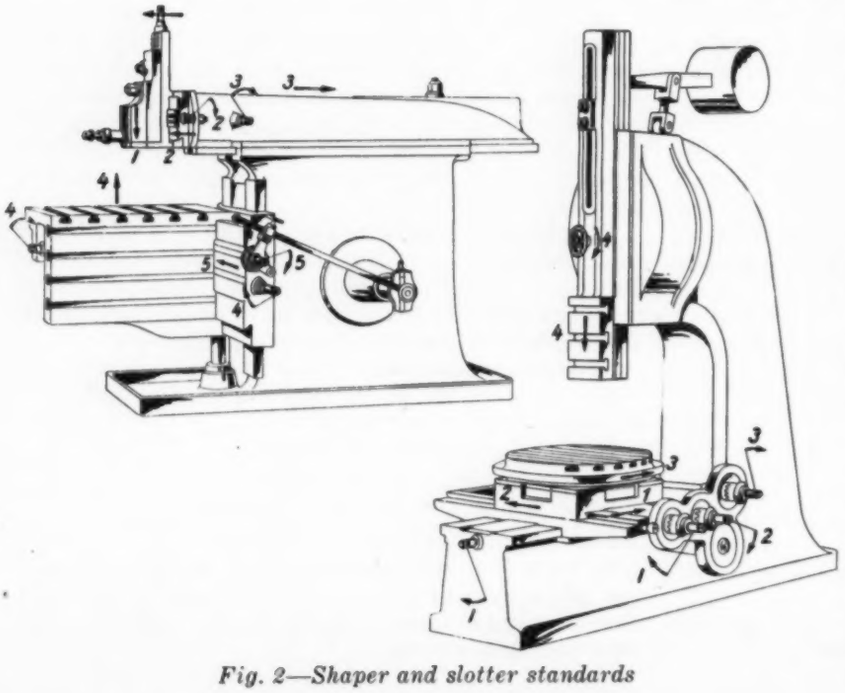


Fig. 2—Shaper and slotter standards

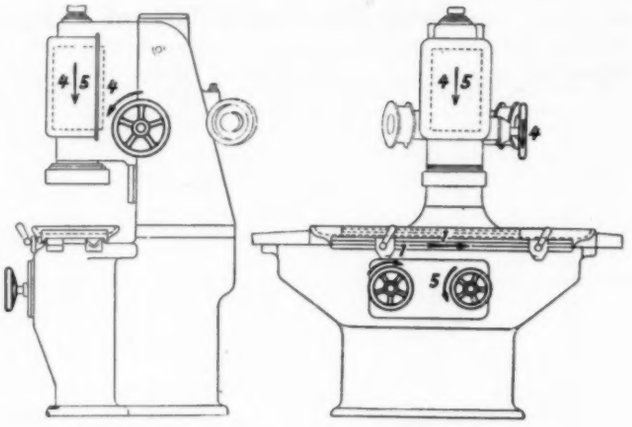


Fig. 3—Movements on German mill

This principle also holds for the shaper, with the exception that the direction of the knee movement is reversed to meet the same condition. The stroke of the shaper ram is lengthened by a clockwise movement of the screw. Clockwise movements on the feeding screws of the slotter also move the slides into cutting positions, but a right-handed movement of the feed screw revolves the worktable counter-clockwise.

For grinders the German standard gives a longitudinal movement to the right with a clockwise turn by the handwheel, when the grinding wheel is on the right, and a movement of the slide to the left when the cutting wheel is on the left. This brings the work always towards the wheel.

In the vertical mill the action of the head is reversed from the general principle, and a counter-clockwise movement of the screw-wheel lowers the head toward the work. This corresponds to the "natural" movement used by American manufacturers for the light type of lever-feed drill press, but is the reverse of the generally accepted American wheel-feed vertical mill or press.

Deciphering the Steel Code

Now that steels are being largely known by numbers it is of interest to know what the numbers mean. The first number indicates the type of steel (1) being used for carbon steel. (2) for straight nickel and (3) for the nickel chromium. The second number indicates the approximate percentage of the alloy and the last two numbers the average carbon content in "points." Thus No. 1020 means straight carbon steel of 20 "points" carbon. The cipher after the first figure shows there is no alloy used. No. 2315 indicates nickel steel of approximately 3 per cent, and 15 "points" of carbon. This method is known as the S. A. E. system.

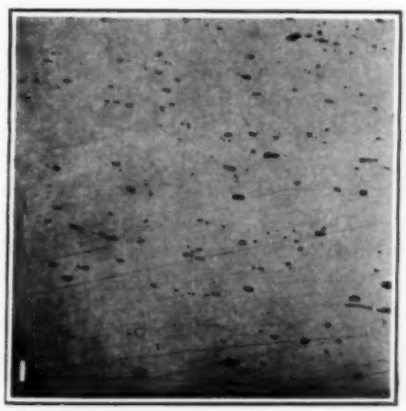
Oxy-Acetylene Welding of Copper

By S. W. Miller
Union Carbide and Carbon Research Laboratories, Inc.

The introduction of silicon as a de-oxidizer in the metal being welded as well as in the welding rod results in the production of sound welds

NEXT to iron, copper is the most important industrial metal and its use, both in the pure form and in such alloys as brass and bronze, is large. The welding of copper articles has not always been successful, a fact that has probably prevented an even wider utilization of copper in the industries, aside from its cost. Recent laboratory investigations made by the author indicate, however, that perfect welds in copper can be readily obtained through the use of properly selected materials.

The difficulties encountered during the manufacture of copper are of interest since they are related to the difficulties that later must be overcome in order to obtain a sound weld. After the preliminary processes that remove the gold, silver, and other valuable elements as well as the impurities, the copper is prepared for casting into pigs. Copper has a strong affinity for oxygen when molten and during the period of melting it becomes saturated with oxygen. If the copper were cast in this condition, the pigs would be brittle and would have a bad appearance and fracture; also the middle of the top face would be lower than the edges. This trouble is obviated by stirring the melted bath with poles made of green wood. If poled too long, all benefit is lost and the cast pigs will be porous with the middle of the top face higher than the edges. When poling is carried to the right point, indicated by test, the pigs will be free from porosity and the top surface will be flat. Such copper is called "tough pitch." This copper is the usual commercial product and it still contains a considerable amount of cuprous oxide, Cu_2O, as shown in Fig. 1. This oxide produces what is called "red-shortness" of the metal in that from the melting temperature down to a dull red heat, the metal is brittle and can be neither hammered nor rolled without cracking. This brittleness is a maximum just below the melting point.



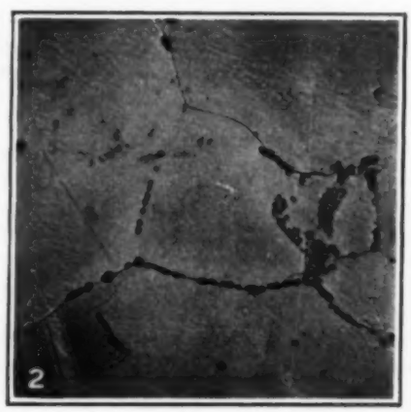


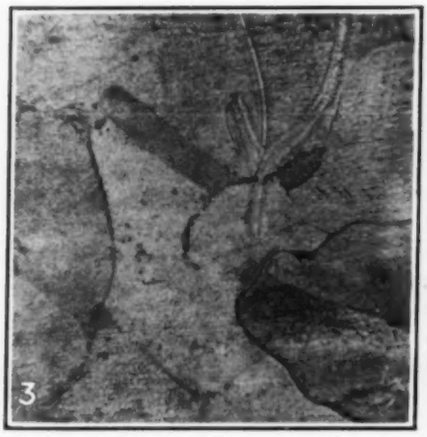
Fig. 1—Distribution of cuprous oxide in commercial copper plate. Fig. 2—Oxide surrounding the boundaries of copper grains

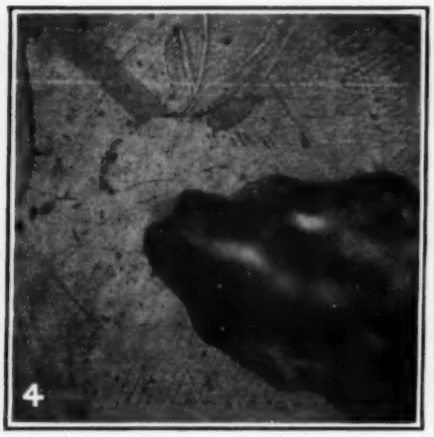
The process of welding raises the metal adjacent to the areas being united to the melting point, at which temperature commercial copper has hardly any strength. Hence, if the slightest stress comes upon the joint immediately after welding, cracks appear and the operation is a failure. The same condition is true when either ordinary brazing or bronze-welding of copper is performed, although the damage is not so great. It is very easy to overheat copper by any of these methods and to reduce the strength of the joint to the danger point.

Much effort has been wasted in trying to correct this trouble by the use of special welding rods containing various de-oxidizers such as silicon, manganese, aluminum, phosphorus or various combinations of them. Some of these special rods seemed to work well under the blowpipe and to produce sound welds, but whenever a test piece was subjected to bending or tension the fracture would occur just next and parallel to the "V" cut for the weld. In the tension tests, failure would occur at the same stress in the base metal regardless of the material of the welding rod. This evidence indicated that the base metal must be defective at the point of rupture and that the rods had nothing to do with the trouble.

A microscopic examination of the metal clearly showed what had taken place. The thin melted zone next to the "V" recrystalizes upon cooling, and any oxide present collects at the grain boundaries, thus weakening the metal. The microphotograph shown in Fig. 2 pictures this condition. Fig. 3 (magnified 430×) also shows oxide grain boundaries in the metal just beneath the weld. This specimen was bent slightly with the result that the grain in the lower right corner dropped out of place. Fig. 4 shows the result. This action is definite evidence of the lack of strength of the oxide film. Further evidence is given by the microphotograph of Fig. 5 which shows a specimen of commercial copper welded with a bronze rod. The first rupture takes place at the grain boundaries of the copper just under the weld.

It has been common knowledge for years that commercial copper is injured when heated by a reducing





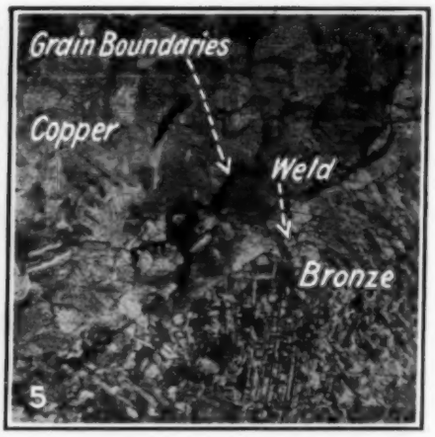


Fig. 3—Oxide at grain boundaries just beneath a weld. Fig. 4—Grain outlined by oxide in Fig. 3 drops out of place. Fig. 5—Commercial copper welded with bronze welding rod

flame. This reducing action is very rapid, as can be seen by playing the envelope flame of a blowpipe across a surface of scaled copper. As soon as the oxide scale has become red hot, the surface changes in a few seconds to the usual red color, indicating copper. Hence, when welding, the oxide, which on first heating segregates at the grain boundaries, is subsequently exposed to the reducing envelope flame of the blowpipe and is reduced to copper. Since the copper occupies less space than the oxide, a void is left at the grain boundaries that further weakens the metal. It is evident from the above discussion that the primary cause of failure in welds was due to the cuprous oxide in the metal. The problem then resolved itself into a search for the most suitable de-oxidizing agent. Silicon answered this purpose best and only a small residual amount, from 0.05 to 0.10 per cent, was found necessary. Silicon-treated copper was cast into ingots 2 in. square and forged to the desired size. There was no difficulty in working it at a sweating heat, just below the melting point, and at no temperature below this was there any cracking. It was quite malleable and could be worked cold. As would be expected, no difficulty was experienced in welding it. The best results were obtained with a welding rod of a composition similar to the base metal.

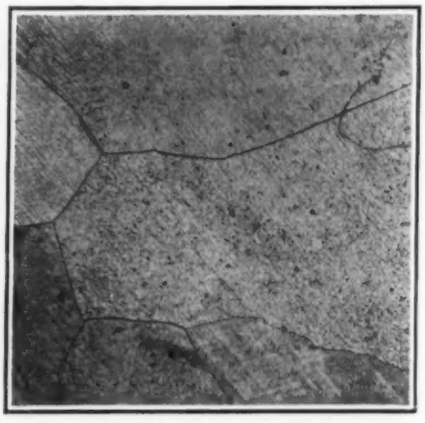


Fig. 6—Weld in de-oxidized copper made with a rod containing 1 per cent silicon

In Fig. 6 is shown a microphotograph of a weld made in silicon-treated copper with a welding rod containing about one per cent silicon. The metal is clean and sound. Table I shows test data on welds in commercial copper, while Table II shows similar data on welds in de-oxidized copper. The differences are quite marked. The average ultimate strength of the de-oxidized copper was 32,000 lb. per sq.in.; these tests would indicate that the best weld was about 92 per cent efficient.

There should be no difficulty in obtaining de-oxidized copper as any manufacturer will make it, if asked to do so. The presence of cuprous oxide in commercial copper can be determined positively by means of the microscope, or practically by heating a piece of the metal to a bright red and then bending or forging it.

Table I—Welds in Commercial Copper

Welding Rod Symbol	Rod De-Oxidizer	Tensile Strength Lb. per Sq.In.	Elongation in 2 In. Per Cent
CSO	Silicon	14,800	6.25
CSI	Silicon	16,450	8.70
MSI	Manganese and silicon	15,100	7.00
CPI	Phosphorus	14,150	8.70

Table II—Welds in De-Oxidized Copper

Welding Rod Symbol	Rod De-Oxidizer	Tensile Strength Lb. per Sq.In.	Elongation in 2 In. Per Cent
CSO	Silicon	29,450	30.0
CSI	Silicon	28,800	32.5
MSI	Manganese and silicon	28,650	27.5
CPI	Phosphorus	19,600	13.7

The welds were neither hammered nor heat-treated. Such treatments would improve the physical properties.

If cracks appear, oxide is indicated and even if, by chance, something beside oxide is the cause of the cracking, the metal is not fit for welding and should be rejected.

There are times when it pays to rebuild an old machine or to convert it to other uses. But there are many more cases where it is money thrown away, owing to inherent weakness in the design or construction of the machine. Better get the opinion of a man with wide experience before turning the machine over to the shop tinkerer.

The use of "chills" in casting was formerly confined to cast iron, and was developed largely in connection with car wheels for freight car use. The practice is being extended to include both aluminum and bronze castings, the object being to solidify the metal where it contacts with the chill, rather than to affect its hardness, as in the case of cast iron. Where aluminum surfaces are to be finished, the use of a chill seems to prevent the minute pin holes that sometimes spoil the appearance of a finished part.

The Functions of a Project Engineer in a Technical Organization

By John F. Hardecker
Naval Aircraft Factory, Philadelphia, Pa.

Complete analysis made of the system whereby one engineer follows through an assignment from the preliminary design to the finished product

THE MOST flexible type of technical organization yet devised that can be successfully carried out in actual practice is the one in which a single engineer is given the task of "living" with a job from start to finish so that at all times he is the one man in the organization who is most familiar with that particular job. This system was developed by large organizations that manufactured a variety of products where it was well adapted. It lends itself readily to the manufacture of machinery, locomotives, automobiles, electrical equipment and, in fact, to any large plant making a number of mechanical or structural products.

The project engineer reports directly to the assistant chief engineer, who makes the assignments and renders decisions as chief project engineer, subject to the approval of the chief engineer. The chief, through his assistant, is kept fully informed of the progress of the engineering phases of the work.

General Duties and Responsibilities

To each project, or job, as it originates is assigned a project engineer, who thereafter handles all correspondence with regard to it, supervises the preparation of plans and specifications, follows up the work through the factory and eliminates conflicts, interferences, and manufacturing difficulties through intimate personal touch with its progress. With respect to each of his projects, he is the source of information for all departments and is particularly the liason man between the customer, the manager, the engineering department, the testing department and the production department. During the life of a project he must expedite its satisfactory completion by suggestions and specifications to the proper department heads with whom he must have close contact. In developing plans and specifications the project engineer usually consults with the specialty engineer, the design division and the testing department.

For example, after a project of major magnitude has been assigned to an engineer, he should immediately begin a study of it and should discuss informally the general features and requirements with those who can best assist him. He then calls a preliminary design conference at which are present the chief engineer and his assistant, the specialty engineers involved, and the head of the analytical section, all of whom have been supplied with data in advance for study. A record of the proceedings is made on a special form, to be described and illustrated below, and copies are sent to those who attended the conference and to the assistant to the manager. As a result of this conference, the project engineer prepares the general specifications and forwards copies to the assistant to the manager, the chief engineer, the production superintendent, and the design division head. General data on the nature of the project such as the type of construction, the general dimensions, the material to be used, and the general assembly drawings (if available), are furnished to the purchasing agent and the chief planner and estimator.

When sufficient time has elapsed to allow a study of this data to be made, the assistant to the manager calls a second conference for completely scheduling the job throughout the organization. The project engineer acts as a general source of information and gives dates upon which the engineering information can be furnished in form for shop use.

The design division furnishes the chief planner and estimator an advance list of parts which are not stock standard and which must be procured from an outside source, and also a list of any special raw materials with the approximate quantities designated. The chief planner then proceeds with the preparation of the purchasing orders on the purchasing agent.

Development of the Design

The specifications and the calculations (if any), the correspondence, the drawings, and all other data on the design as decided upon at the preliminary design conference, the model or the machine symbol and information as to the priority or urgency of the project are sent the chief draftsman by the project engineer. The latter has the authority to introduce and is responsible (subject to the approval of the chief engineer) for the novel features and the working up of the design. In order to develop the plans from the instructions, specifications and analyses, it is necessary that these be prepared as far as practical in advance of the drafting. It is essential also that draftsmen be given a clear idea of the details as the project engineer conceives them. Reciprocally, the design division personnel must also keep themselves well posted and must be on the alert to suggest ideas on details. By such co-operation, much time will be saved on the layout, the detailing and the checking. Changes usually mean both improvements and extra costs, and they should be carefully weighed by the project engineer before they are authorized by him. The chief draftsman is generally

responsible for the methods and procedure in the drafting room, but he should be advised and consulted with on these details. Before being issued, each drawing should be approved and signed by the project engineer.

The project engineer should keep in close touch with all calculations, such as stress analyses. He should consult with the specialty engineers as required. He should also request all tests, preliminary construction work and work-ups, by means of the prescribed form.

When the detail drawings are issued the work is proceeded with in accordance with the previously arranged shop schedules. The project engineer should keep in touch with the work as it progresses in order to anticipate interference, delays and errors as far as possible. He should be familiar enough with shop practice to get the details into the drawings to the best advantage from a manufacturing standpoint.

Changes

When a customer requests a chance (chargeable to the customer) the project engineer notifies all concerned as follows by the use of the form, giving the following information:

1—Number and name of change.
2—Brief description.
3—Number of units in which the change is to be effected.
4—Statement as to whether the drawings are to be issued or revised to cover the change.
5—Amount of special material required to be purchased, or specially fabricated.
6—Recommendation for disposition of material affected by the change.

If changes are brought about through errors in the drawings, or as a result of suggestions by the shop personnel, they are put into affect in the same manner as for a customer's changes.

All changes are also classified as follows from the point of view of the disposition of the material involved:

Class A changes are effective at once; manufactured stock must be scrapped and standard parts salvaged.
Class B changes are likewise effective at once; parts are to be reworked.
Class C changes are effective and affect stock according to the customer's instructions.
Class D changes take care of routine work on drawings only and do not affect stock.
Class E changes become effective after run out of parts on hand, in process or on order. They do not affect stock.
Class F changes are effective at once; additional parts are required.

Project Records

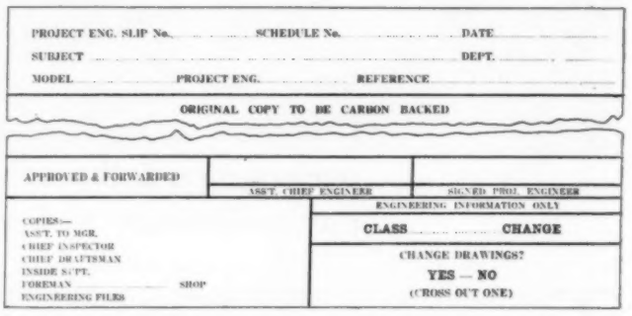
The project engineer's form (see illustration) is used to send information to the design section and production department under the following circumstances:

1—When changes are found necessary in drawings after being issued.

2—When, due to shop errors or interferences, the work in the shops must be completed in a manner different from the drawings; or instructions must be sent to stop work until the drawings are revised; or information must be furnished in advance of the change in drawings so that work may go ahead.

These forms are usually written long hand with accompanying sketches; the originals (carbon backed) are blueprinted for distribution. A carbon copy may also be made and given to the shop foreman or any other person concerned, if immediate action is necessary.

A check file of these forms is maintained by the engineering files which acts as a complete history of each project. This file will allow of checking the numbers to see that none has been missed as the forms on a particular project should be numbered consecutively; it will insure that all concerned are properly informed, and that the drawings are changed as may be required; it will allow of a ready follow-up of the situation at any time; it will permit a relief to take over a project with full information before him, and it will relieve the project engineer from considerable clerical work. In order to get the full benefit, it is absolutely necessary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APPROVED & FORWARDED | ASST. CHIEF ENGINEER | SIGNED PROJ. ENGINEER
COPIES:—
ASST. TO MGR.
CHIEF INSPECTOR
CHIEF DRAFTSMAN
INSIDE SUPT.
FOREMAN ..... SHOP
ENGINEERING FILES
ENGINEERING INFORMATION ONLY
CLASS ..... CHANGE
CHANGE DRAWINGS?
YES — NO
(CROSS OUT ONE)

Form used by project engineer to transmit orders and changes

that these forms be used in sending out all data, information, or instructions in connection with each project. The size of the form may be varied; the essential points of the system are the serial number, the complete information as outlined above and the filing of the forms.

The project engineer should represent the engineering department on the salvage committee (where there is one) and should pass upon all rejected material from an engineering viewpoint, recommending reconditioning or repairing, where practical, of rejected parts. He should also pass on all substitutions which may be offered for his consideration due to the materials specified on the drawings not being available in the shop at time the work is going through the shop.

The preceding has been an outline in full of the functioning of the project engineer on a major design job. The system is purposely so conceived, that it is very easy to use only that part which would be applicable to a small job, to a repeat order, or to a small modification of a standard type. In these instances much, or practically all, of the formality of the preliminary work may be dispensed with, but the machinery for coordinating the essential shop work still remains.

Wasting to Save Waste

By G. B. Stuart

So much is being written about elimination of waste in factories, that it seems we are going to pass through one of those overdone cyles such as the efficiency "bug," or the after-the-war export "game." It looks sometimes as if the man in charge of waste elimination is willing to spend good dollars to save cents.

It is often easy to save the first 75 per cent of the waste, but it is then poor policy to spend a disproportionately large part of the total savings to try to eliminate the other 25 per cent. I recently saw installed an elaborate card index system that took constant daily attention, and saved only five minutes about once a month. The "free hand" should generally be withheld from the waste and efficiency man until he has demonstrated true economy in his waste elimination.

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

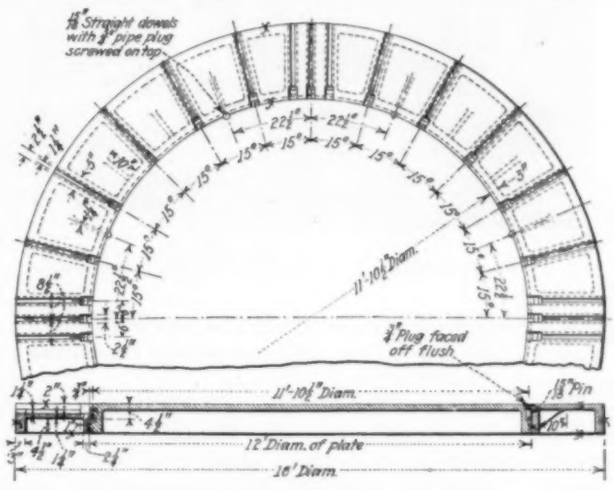
Increasing the Diameter of a Boring Mill Table

BY P. S. KLICK

In our shop we have a 16-ft. boring mill with a 12-ft. diameter table, and we have always found that we were handicapped, because on the big jobs where we needed the best support we always had the poorest. Furthermore, the parallel blocks, or outriggers, that we used to support big work were very dangerous if a man should happen to be caught between them and the frame of the mill.

A new table would have required a very heavy casting, and would also have involved the refitting of the table gears and spindle. A sub-table, bolted on top of the regular one, would have interfered with the use of the T-slots and would also have cut down the available height. It was finally decided to build the table out to 16 ft. diameter by means of the extension shown in the accompanying sketch.

The outside edge of the table was turned down to a shoulder as the sketch indicates, and the annular extension piece was bored to match. The bore of the



Extension for boring mill table

extension was made $\frac{3}{4}$ in. smaller than the diameter of the newly turned shoulder on the table. The extension, after being bored, was taken to the foundry and heated in one of the core ovens to a temperature of about 700 deg. Fahrenheit.

When the extension was taken from the oven, the bore was measured and found to be about $\frac{5}{8}$ in. larger than before heating. But twenty-four minutes elapsed from the time the oven was opened until the extension was in the machine shop, ready to be lowered into place on the boring-mill table; notwithstanding the fact that it had to be transported a considerable distance across the shop yard in cold weather. When ready to lower, the bore was again measured and found to be about $\frac{1}{2}$ in. oversize.

The extension was put in place and allowed to shrink tight, but just before the space between the extension and the table closed entirely we poured a solution of sal-ammoniac into it.

Dowels were set in the joint, as shown in the sketch, with one-half the diameter of each dowel in the metal of the table and the other half in the extension, but after a husky cut was taken over the top of the extended table everybody was pretty well convinced that the dowels were not necessary.

The slots shown in the sketch of the extension, were, of course, in line with those of the table. In order to be sure of the spacing, we first made a 12-ft. diameter wooden ring and placed it in position on the table while we marked the location of the slots on the edge. This ring was then used in the foundry as a guide in setting the cores. A match mark was made on the table, the wooden templet and the new casting.

The square pockets on the inside edge of the extension were made to facilitate the setting of bolts in case there should be a slight mis-alignment of the slots, which, however, was not the case. The pockets are of advantage, however, when removing chips from the slots.

We were well pleased with the job, and so far have experienced no trouble because of the increased weight of the table.

An Automatic Recessing Toolholder

BY H. B. SCHELL

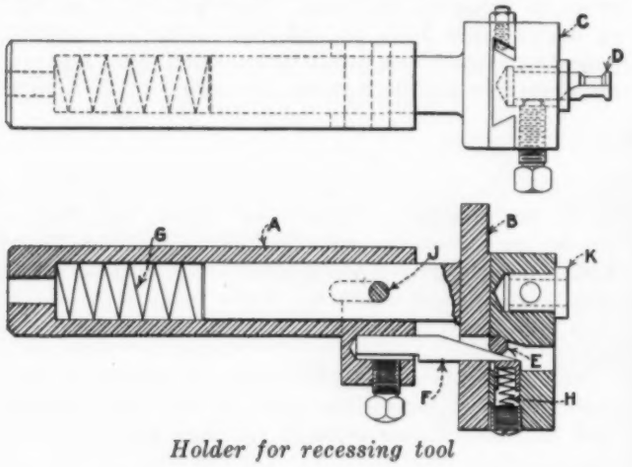
The recessing toolholder shown in the sketch was developed for use in automatics and turret lathes. It proved to be one of the most useful tools of the kind we have ever used.

It consists of the body *A*, which is held in the turret; the slide *B*, the shank of which is a sliding fit in the body; and the toolblock *C*, so disposed in the dovetail slot of the slide as to permit crosswise motion.

The action of the device is as follows: With a recessing tool, *D*, of the proper shape and position to give the required form and location of recess, and with the turret in the proper position, the tool is advanced to the work, entering the bore until an adjustable stop on the machine comes in contact with the ledge on the slide provided for that purpose.

Any further forward movement of the turret will cause the shank of the slide to telescope into the body. This movement causes the pin *E* to ride upon the tapered surface of the pin *F*, which, being rigidly fixed in the body, causes the toolblock to move crosswise and feed the cutter into the work, cutting the desired recess.

Upon the completion of the cut, the turret is withdrawn, and the springs, *G* and *H*, return the toolblock



Holder for recessing tool

to its original position, bringing the tool central. The telescoping movement of the slide is governed by the pin *J*, in the body.

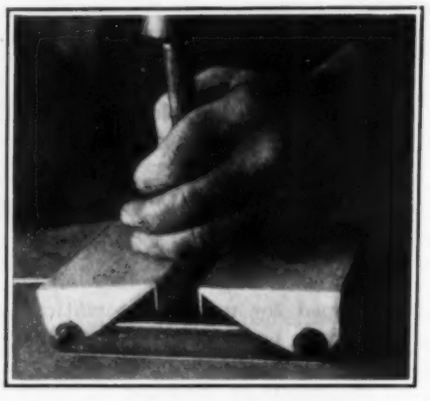
The bushing *K* is provided so that tools having various sizes of shanks may be accommodated.

On machines where the stop for telescoping *A* and *B* was impossible, the flange of the hardened bushing was permitted to bear against the end of the work.

Hold Down for Use in Cutting Off Wire

By Arthur Kendall
Montreal, Canada

Cutting off pins, or short pieces of wire, can be as dangerous as any job if a hammer and chisel are used, and since these tools are mostly used by the smaller shops for such jobs, the hold-down illustrated should be of interest to them.



Device to hold wire for cutting

The device consists of a flat block of iron and two sheet metal pieces, both bent alike, to fit over the sides of the block with a further bent down piece at the front. Four screws and washers, two on each side, complete the device, both sheet-metal parts turning easily on the screws. In operation, the wire is slipped beneath the two pieces, with the part where the cut is to be made somewhere between them. The hand that holds the chisel rests on both sheet-metal pieces, pressing them onto the wires at both sides of the cut, preventing the wire from flying up as the chisel goes through.

Special Machines for Turning Balance Wheels

By Milton Wright

A special machine that was designed many years ago to turn the balance wheels of sewing machines is still in service at the Bridgeport plant of the Singer Manufacturing Company.

The machine, shown in Fig. 1 with a finished balance wheel upon its arbor, is very simple, both in design and construction. The balance-wheel casting, having previously been bored, the hole reamed and the hub faced on both sides, is placed upon the stud arbor of the machine

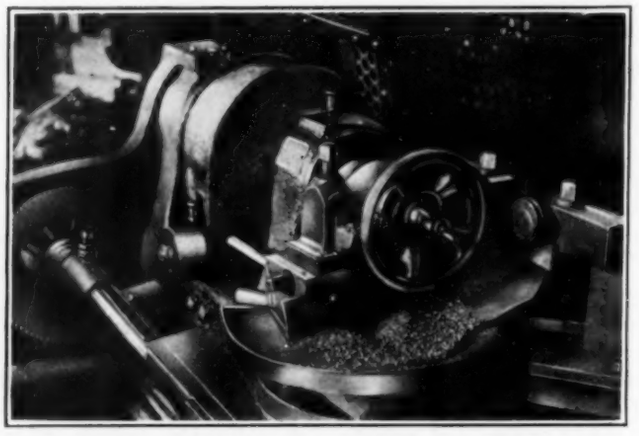


Fig. 1—Machine to turn balance wheels

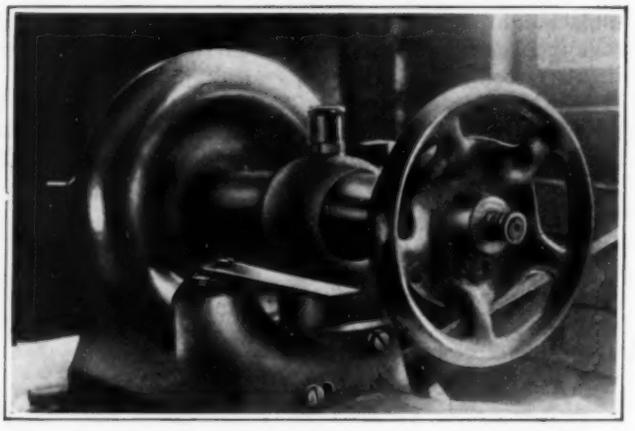


Fig. 2—Device to test the wheel for run-out

and secured by means of a nut and washer. The faceplate carries a positive, balanced driver to engage the spokes of the wheel.

The turntable of the machine is carried upon a vertical shaft below and in line with the center of radius to which the rim of the balance wheel is to be turned. A double cross-slide upon the turntable permits adjustment of the turning tool in two directions at right angles with each other. The turntable is rotated by a worm and wormwheel, the latter being keyed to the vertical shaft beneath the bed of the machine, and the former deriving its rotative motion through an extension shaft and train of change gears from a pinion on the rear end of the main spindle.

The section of the rim to be turned is a ribbed semicircle having the sharp corners where the circular cut runs out, chamfered at an angle, of about 45 deg. by a pair of inverted, circular forming tools carried by inde-

pendent slides that bring the tools forward from the rear of the work. The slides are actuated by a cam on the vertical shaft of the turntable. The chamfering tools come into action just after the radius-forming tool has completed its movement.

The device shown in Fig. 2 is for the purpose of testing the run-out of the finished wheel. The wheel is wrung upon the stud arbor and the shaft is spun by a movement of the operator's hand over the heavy-rimmed balance wheel, which, by virtue of its momentum and the freedom with which the shaft turns in its bearings, will run for a considerable time. That accuracy of product is attained is attested by the fact that a run-out of more than 0.001 in. in either plane—an amount scarcely perceptible to any except the trained eye of the operator—will not be tolerated.

A Tool for a Difficult Job

By Alfred T. Gregory

A tool used for turning the spherical bottoms of aluminum cylinders is shown in the illustration. The tool is used in the turret of a Gisholt turret lathe, the work being held in a large boring fixture on the spindle of the machine.

The body *A* is slotted in the end to receive the cutter bracket *B*. This bracket is pivoted to the bar by the pin *C*, permitting the cutter to be swung on a radius. The rack bar, *D* slides in a lengthwise hole through the body of the tool and carries at its end the shoe *E*, which engages the angular slot in the cutter bracket. As the rack bar is caused to slide forward or back, the cutter bracket is thereby turned about its pivot, thus guiding the cutter through the required arc.

In operation, the tool is moved into the work with the cutter in the central position. A hand wheel (not shown) is secured to the shaft *H*, and by turning this wheel, the rack bar *D* is operated through the worm, worm gear and spur gear shown, permitting the tool to be given a slow steady motion across the work. During the operation, the tool is supported by the three guides *J*, which are ground to a running fit in the work. After the cut has been completed, the worm can be disengaged from the worm gear by swinging back the supporting arms *K* and *L*, which are secured in position by the lock screw and handle *M* and *N*. The rack can then be operated directly by turning the handwheel *O*, and the cutter can be brought back quickly to its starting point, thus permitting the tool to be withdrawn from the work.

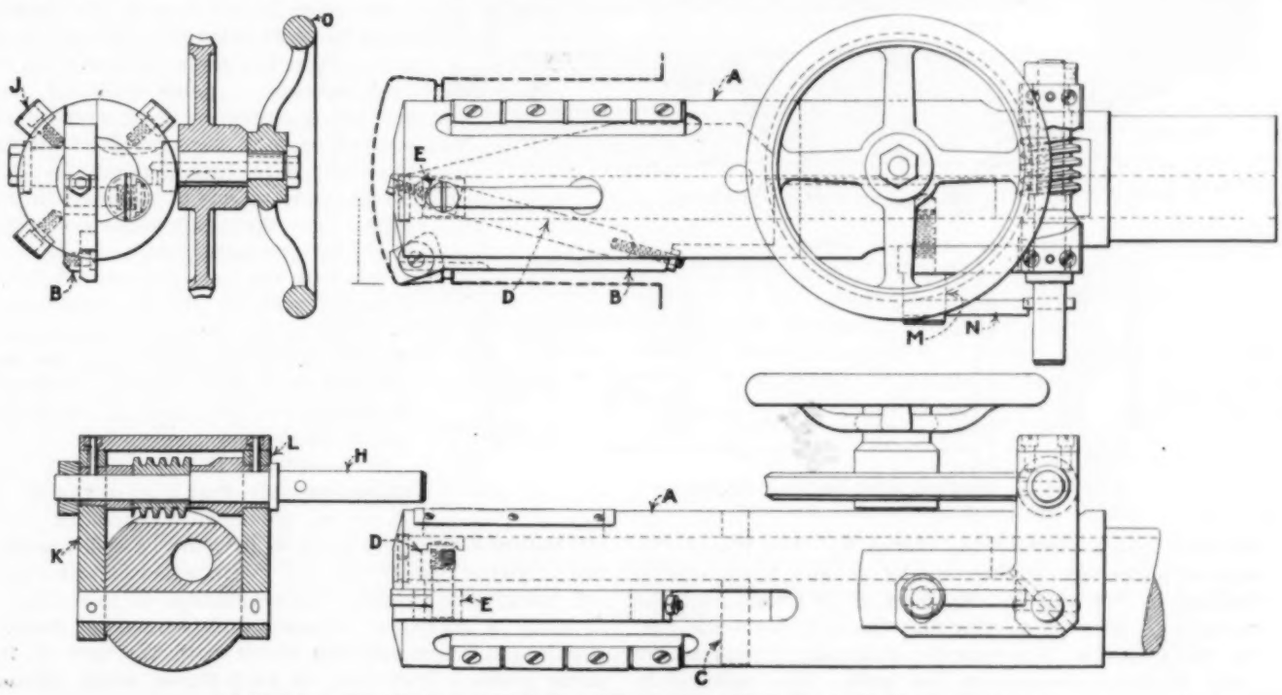
Shrinking a Cylinder on a Brass Lining—Discussion

By F. M. A'Hearn

The inquiry on page 172, Vol. 64, of the *American Machinist*, concerning the feasibility of applying a shrink-fit brass liner to a 12-in. pump cylinder, brings up a question that the writer does not remember having ever before seen discussed through the columns of the *American Machinist*.

Heating a casting, shaped as the water end of a pump is usually made, in order to obtain sufficient expansion to permit application of a liner, involves a hazard of unequal expansion in the piece being heated. This frequently results in breakage. Another objection is that a liner with ⅜-in. wall will rapidly absorb heat from the cylinder during the application of the liner. Any delay in putting the liner to place after once entering it into the bore, is almost sure to result in the liner seizing or sticking. Should this occur, the removal of the liner without unfitting it for further use is doubtful.

The editor's opinion that the liner will be loose when the cylinder cools, is shared by the writer. A cylinder with a liner similar to that described was among the equipment involved in a shop fire. In this case the liner was very loose after cooling, due to the difference in expansion of cast iron and brass.



Tool for machining spherical surfaces in cylinders of airplane engines

Liners in cylinders subjected to hydraulic pressures of approximately 6,000 lb. per sq.in., are sometimes made tight by burnishing or spinning the metal of the liner, thus expanding it tightly against the cylinder wall. This work is usually done before removing the cylinder from the boring mill. The bore, if "belled" or rounded at either end, permits beading the liner at the ends to retain it in its place.

It is probable that the liner mentioned in the inquiry may be successfully applied by making it a force fit and pressing it in by means of a jack, or by the use of a heavy draw bolt. If it is possible to bead or caulk the ends of the liner after application, it is well to do so. Should beading or caulking not be feasible, the end of the liner may be made with a flange or with lugs to permit the use of studs or bolts for fastening it so there will be no danger of end movement.

Some pumps have liners secured by a bridge or crab similar to that used with boiler man-hole plates. The crab is fastened to the end of the flanged liner, and is provided with a seat in the center for a heavy setscrew. The screw, with a jam nut, is fitted to the cylinder head and tightened after the cylinder head has been drawn to its seat.

Tool for Finishing Combustion Chamber

By Harold A. Peters

A motor with a solid-head cylinder block called for a machined combustion chamber. This operation was accomplished on a vertical drilling machine with the tool illustrated.

Referring to Fig. 1, *A* is a machine steel body with two pivoted cutter blades *B*, kept in tension by the springs shown. The spring plunger *C* has a head on the end which controls the blades *B*. The plunger is forced outwardly by the spring *D* and its travel is limited by the pin *E*. Bushing *H* is ground on the outside to allow it to slip into the cylinder bore, and on the inside to slip over the body *A*. This bushing once in place remains on the body. The collar *I* is threaded on the outside and ground to a slip fit on the body *A*. A hole is drilled through each side of *I* to a press fit for pin *E*. Pin *E* is slightly shorter than the diameter of the collar and is assembled while collar and plunger are in place. When this is done, collar *I* and plunger *C* will be tied together and both allowed to slip back and forth ¾ in., or the length of the slot in a body *A*. Lock collars *K*, *L* and *M* are used to regulate the travel and expansion of the cutter blades.

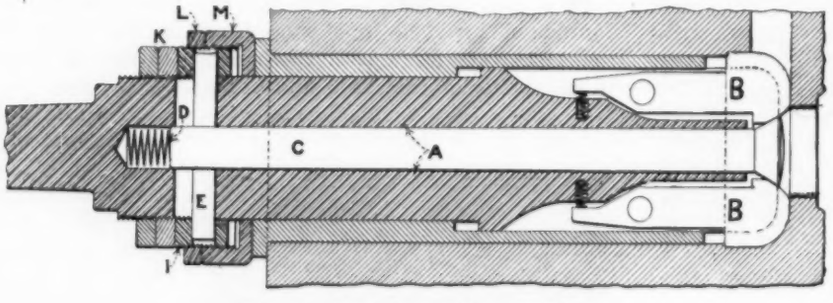


Fig. 1—Tool in cutting position

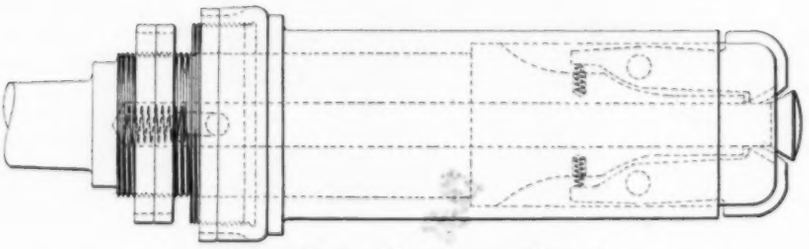


Fig. 2—Tool with cutters collapsed

In operation, the bushing *H* containing the tool proper, is inserted into the cylinder bore until the head of the bushing rests on the cylinder block. The tool is then in its cutting position, as shown in Fig. 2. The machine is now started and the tool is fed down, expanding the blades by the plunger head until the lock collars *K* bear against collar *I*, as in Fig. 1, thus stopping the travel and bringing the tool to the position shown.

Multiple-Operation Press Tools—Discussion

By Amos Ferber

Multiple-operation press tools of the kind shown and described by John Strama on page 251, Vol. 64, of the *American Machinist*, are always admirable—if they work. They are often advantageous in the matter of rapid production, and are *sometimes* warranted by the conditions prevailing in the shop where they are to be used. They have their drawbacks, however, and it is too often the case that their disadvantages are not fully considered in reaching the decision to make them.

In the first place they are always complicated and therefore expensive to make. They are also expensive to maintain; for not only does the complexity of their construction make even the most minor correction or repair a much more costly job than would be involved if simple single-operation tools were used, but such correction or repair is likely to be necessary much more often.

In my opinion a tool of this nature is hardly ever warranted in any shop where there is a multiple-operation, or "cut-and-carry," press available, for in such a machine six or even more operations may be carried on simultaneously with very simple tools. An accident to any one of the tools in the latter case, though it shuts down the press for the time being, can be corrected with the least possible delay and expense, whereas the multiple-operation tool under similar conditions will require almost as much time and entail almost as much expense as would be involved in the repair of the entire set of single-operation tools.

Of course, if there is no such machine available, that is an argument in favor of the more complicated tool; but before deciding to build it, it would be well to study the probable cost of the tool (with generous allowance for unexpected delays), the percentage of time that it is likely to be out of business and the cost of making repairs, and compare the result with the cost of the same product from two, or even three, single presses fitted with simpler tools.

Characteristics of Genelite

Genelite is a spongy bronze having approximately 40 per cent by volume of graphite mechanically mixed with it and uniformly distributed throughout its mass. If the material is pictured as a metallic sponge of bronze with its pores filled with graphite, a conception of its peculiar physical properties will be obtained. This structure naturally gives it a low tensile strength on account of the reduced net area of metal in cross section, but it also gives it a high resistance to compression due to the filling of the pores with graphite. The porosity due to the graphite allows the metal to absorb about 3 per cent of its weight of oil, which is equivalent to about 20 per cent by volume, and also gives it a capillary nature.

As a Bearing Metal

The chief use of Genelite is for a bearing metal. The graphite present at all times acts as a solid lubricant, and permits the metal to function as a bearing with a minimum of oil, while its porosity and capillary action insures even distribution to the bearing surface of any oil that may come in contact with any portion of it. These features, together with the fact that a Genelite bearing will not freeze or cut the shaft, enable this material to give highly satisfactory service in some places where it is difficult to use ordinary materials, and to replace them in other cases, with much improved performance.

Genelite is also used for bushings for piston pins, crank pins, cam shafts, or for sealing rings for small engines or compressors. In such places as guides, transfer shafts, or on slide bars, where motion is infrequent, but where it must be free and positive, Genelite is not likely to gum and stick.

For vertical shafts or other places where it is difficult to lubricate directly, advantage may be taken of the nature of Genelite, and the oil brought to the bearing surface by means of capillarity. It is only necessary to bring some portion of the bushing into contact with the oil, and capillary attraction will take it to the bearing surface as fast as it is used up, provided that a good grade of thin oil is used. In such applications there is no fear of oil leakage, for the oil will not run out and drip from the surface.

Where Genelite is used for such purposes as sealing rings it is sometimes necessary to fill the pores of the material to prevent leakage. Sealing can be done by soaking in a substance that can be liquefied either by heat or solution, but will become solid under the conditions of service. Paraffine is used for sealing in many cases.

For Valve Facings

Another use of Genelite is for facing on the rotating part of valves used for caustic solutions. In such places it is self-lubricating, and prevents sticking of the stopcocks, where it would be impossible to keep an ordinary valve lubricated with oil. It has also been found effective in the same manner in valves for oxygen and hydrogen-producing plants.

Difficult to Machine

Genelite cannot be readily machined by ordinary methods, since it dulls the tool very rapidly. The cut is ragged, and the machined surface looks as if the metal were torn out instead of being cut. It can, however, be ground easily when the proper wheels are used.

Because of the machining difficulties, flanged bushings or complicated shapes are difficult and expensive to make. In the case of a flange, for example, the blanks must first be made the full diameter of the flange, and then ground down to the body size. Split bushings also present a problem, for unless provision is made for a shim of sufficient thickness so that a solid bushing can be split by a thin saw and both halves used, two full, solid bushings must be made in order to get one split bushing. In addition to the extra work involved in such a case, the cost is increased by the fact that the unused material has a very low scrap value.

A simple, straight bushing, without flanges or grooves, is the ideal for Genelite from a manufacturing standpoint. It is not desirable to try to make bushings with thin walls, since any saving in material thus accomplished is more than offset by added difficulty in handling, due to ease with which they may be deformed. For instance, a bushing of $\frac{3}{4}$ in. inside diameter, with a wall $\frac{1}{16}$ in. thick, can be deformed several thousandths of an inch by pressure with the fingers. Wherever possible, the minimum wall thickness should not be less than $\frac{1}{16}$ in. for bushings of $\frac{1}{2}$ in. inside diameter, and should be increased proportionally as the size increases. However, bushings of $\frac{1}{2}$ in. diameter having $\frac{1}{16}$ in. walls have been made, though they are apt to reach the customer in a deformed condition. Genelite, however, conforms to the shape of the hole into which it is pressed, and this trouble is not serious.

In using Genelite, it should always be completely supported. That is, there should be no large holes in the bushing housing, nor overhanging portions to the bushing, particularly on the load side, for the same reason that a babbitt bearing is always fully supported. The running clearance used should never be less than that used for bronze in the same place, and preferably should be 25 per cent higher. The allowances made for press fit should be about double that used with bronze. The hole will close in an amount approximately equal to the compression of the outside. With full understanding of the peculiar properties of Genelite, very satisfactory results can be obtained, where otherwise failure is certain.

For the data given we are indebted to the Research Laboratory, General Electric Co.

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Alloy for Babbitt Hammers

Q. Kindly advise if you can furnish me with a specification, analysis, or proper mixture for babbitt hammers.

A. The original babbitt alloy was made with 88.9 per cent tin, 7.4 per cent antimony, and 3.7 per cent copper, but there is an unlimited number of formulas now in use, many of which also include a percentage of lead. The accompanying table (Vickers' tests) shows the deformation and hardness which you may expect in hammers made from various babbitt alloys.

Test of Babbitt at 5,000 Lb. Pressure Cylinders, 1¼ In. in Diam. x 2½ In. High

Per Cent of Metal				Deformation Inches	Brinell Hardness
Copper	Tin	Anti-mony	Lead	at 70 Deg. F.	at 70 Deg. F.
4.5	91.0	4.5	None	0.001	28.6
3.5	89.0	7.5	None	0.0015	28.6
3.3	83.3	8.3	None	0.0045	34.4
3.0	75.0	12.0	10.0	0.0025	29.6
2.0	65.0	15.0	18.0	0.0030	29.6
1.5	20.0	15.0	63.5	0.0050	24.3
None	10.0	15.0	75.0	0.0050	24.1
None	5.0	15.0	80.0	0.0090	20.9
None	5.0	10.0	85.0	0.0120	19.5
None	2.0	15.0	83.0	0.0100	17.0

Cutting Cast Iron with the Torch

Q. A short time ago I noticed an autogenous welder cutting cast-iron blocks with a welding torch. Would you tell me how this is done, and the principle of the operation?

A. There is no great difference between this operation and that of cutting steel by the same method. The melting point of cast iron, however, is enough lower than its oxidizing point so that there is a tendency for the iron to melt and clog the cut before the metal oxidizes. This is overcome by using a more powerful flame in order to blow away the oxides as fast as they are formed, leaving a clear-cut path.

Designing Wire Coil Springs

Q. I frequently have to design coil springs to meet given conditions in tool work. Is there any formula or method of figuring the action, or "spring," having given the diameter of the spring, size of wire, and pitch?

A. A simple formula sometimes given for the deflection of springs is $F = \frac{6{,}400R}{DG}$, where F is the deflection per coil for each 100 lb. of applied force, R is the mean radius, or radius from axis of the spring to the center of the wire, D is the diameter of the wire, and G is the torsional modulus, the latter being 12,000,000 for steel wire springs.

But as all factors in the formula are variable, and will also vary with different grades of wire, the tool designer, who has occasional springs to specify, generally finds his experience of more value than the formula. For a given class of tool work the drafting room can readily standardize on a few sizes of wire and a relatively small number of spring diameters. The exact calculation of springs is more complicated, but is employed when quantities of springs are required for commercial machines or mechanisms. In such cases we recommend writing to one of the companies specializing in the manufacture of springs.

Low Fusing Brazing Wire

Q. I have made many efforts to obtain a low fusing brazing wire for use on fine, thin brass work. I would like some with a fusing point between 1,400 and 1,500 deg. F., or even less. Could you tell me what to use for the work?

A. If you desire a brazing wire with a fusing point below 1,500 deg. F., it will be necessary for you to use what is known as "silver solder." There is a 20 per cent silver solder on the market with melting point at 1,400 deg. F., and which flows freely at 1,600 deg. F. All of the brass brazing wires have melting points above 1,600 degrees.

Making Steel Wool

Q. We have a client who desires us to make the necessary tools for the production of a "steel wool." Can you give us some general information on the manufacture of this product?

A. One method of manufacture of "steel wool" is as follows: Heavy steel wire from a reel is passed over a bench to another reel on which it is wound by power. Cutters mounted in a framework over the bench dig into the wire, which is kept taut against them. The edges of the cutters are ground on a coarse abrasive wheel so that their edges are roughened. The fine threads of steel obtained are known as steel wool.

Hardening Large Steel Disks

Q. I have several circular carbon-steel plates to harden. These plates are 5½ in. diameter, ¼ in. thick, and have a 3-in. hole through the center and three ¼-in. holes spaced around the blank. I have a small shop with no special appliances for hardening. Can you tell me how to harden these plates with as little distortion as possible? It would be sufficient if the outside were hardened ½ in. from the edge all around.

A. From your description of the plates it would appear that you would obtain good results by fastening them on a 3-in. arbor between two heavy steel collars. If heated and dipped in this way they should not warp, and should be harder on the outer rim, as you desire.

Technical Abstracts

Koltchougalumin

A new aluminum alloy containing small quantities of copper, nickel, manganese and magnesium has been prepared by the Russian metallurgist Boutalov at the Koltchougino Works, a part of the Union of State Industries. The new metal is called Koltchougalumin and resembles duralumin. The alloy has a specific gravity of 2.8 and a tensile strength of 85,000 lb. per sq.in. It can be forged or drawn either hot or cold, even after having been cast, without undergoing any previous heat-treatment. When heated to 500 deg. C. and then cooled rapidly, it hardens but its mechanical properties do not become fully improved until after about eight days.—*Automotive Industries*, April 8, p. 605.

Fractional Motorizing

Driving machinery by electric motors has gone through a process of evolution by which the power has been carried in the wire closer and closer to the work. At first machines were driven from long lineshafts with power directed from one large motor or engine. Gradually lineshafts were shortened until the ultimate step was reached of an individual drive on each machine tool. Now comes what would seem to be the actual motorizing of machines by motorizing each activity of the tool by having several motors on it. This practice is being rapidly adopted for machines of complex nature and is called fractional drive. Woodworking machines lend themselves readily to built-in motors mounted on each spindle, drum or cutter. R. H. Rogers, General Electric Co., in *Manufacturing Industries*, March, 1926, p. 171.

Overhead Conveying

The initial cost of the overhead type of conveyor in mechanical handling invariably runs considerably below other types; namely, platform and apron conveyors; and it is possible to carry articles up or down or around any curvature in a horizontal plane, or at any angle from which the work can be hung.

With this type of system you can bring the various operations into a connected link, almost regardless of where they may be located in the plant, the connecting link being the overhead chain conveyor itself, regulating the flow of production, determining the rate of production, avoiding congestion, making for orderly, careful inspection and resultant increasing of quality. Jervis B. Webb, in *Industrial Management*, March, 1926, p. 151.

Vocational Rehabilitation

With an average of 180,000 persons per year suffering permanent or partial injuries, it is apparent that there is a definite need to conserve our human resources. The actual money spent on the 692 persons returned to gainful employment in 1925 amounted to $63,965. The return in wages for this group was $789,000 for the first year.

Disabled persons cannot be rehabilitated in groups. Because of varying degrees of disability, education, age, capacity, energy or determination, each case presents its own specific solution. Trade schools, technical schools, universities, shops, factories and other existing training agencies are used if the rehabilitation program calls for a formal type of training.

As far as it goes the worker's compensation act works a great advantage to labor in rendering adequate medical and surgical treatment, hospitalization and providing a maintenance wage during the period of incapacity, or compensation for the loss of members of the body. However, this does not provide a means of readjusting the workers to employment. This has been left to the injured man himself, and it has been found that in a majority of cases that a readjustment, if any, is a poor one. With the founding of the Civilian Vocational Rehabilitation movement, the cycle has been completed and the great group of incapacitated workers are being taken into industry and being trained for different kind of work suitable to their capacities. Marlow B. Perrin, in *The Foremen's Magazine*, March, 1926, p. 14.

Nitration Hardening

The main advantage of the nitration casehardening process developed in Germany, is that machine parts can be hardened after finishing without distortion. The objects are exposed to nitrogen *in statu nascenti* at a temperature of less than 500 deg. C. The effect is so uniform that no warping is to be feared. Only for very deep nitration of large objects is it necessary to make an allowance for a slight increase in dimensions. This increase is so regular that tables can be made for allowances.

Nitration produces a higher hardness (900 to 1,000 Brinell) than ordinary casehardening and the transition from the case to the core is so gradual that no spalling is to be feared. However, it is somewhat more difficult to produce penetration than with ordinary casehardening and nitration is applicable only to certain kinds of alloy steels. These steels do not differ very much from ordinary chromium and chrome-nickel steels, but appear none-the-less at present to be proprietary steels manufactured by Krupp.—*Maschinenbau*, Feb. 18, p. 161.

Reliability in Welding

Experience and observation warrant the statement that at present it is no more difficult to train men to make perfectly satisfactory welds, than it is to train them to make any other satisfactory product. Some may find it hard to realize this, but it is true, and it has been proven so many times in the last two or three years, that to deny it would be simply to deny the facts.

The achievement of the feat of welding of 140 miles of 8-in. pipe by 44 welders who made 18,000 welds in which the only defects were four pinhole leaks, which were calked, is one instance. This pipe is an oil line operating under a maximum pressure of 750 lb. per sq.in., and during a severe storm was in places washed out of the trench 20 feet from its position. It was pulled back into place without stopping the flow of oil and without any leaking. S. W. Miller, in *Journal of the American Welding Society*, Feb., 1926, p. 25.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

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Standby Equipment

IF MACHINES and tools were built on the lines of the "Deacon's one-hoss shay," and we knew what the life would be, the question of standby equipment would be greatly simplified. As this is not the case it is necessary to allow for failures of machines, both from accidents due to the operator, and to wear in the machines or tools used.

The amount of standby equipment necessary depends on the urgency in maintaining production. In a shop with a large output the failure to produce a single part may delay the shipment of hundreds of machines, tie up capital and injure the reputation of the firm for prompt delivery. In such a case a heavy investment in standby equipment is justified.

It is often a problem to know when to buy an extra set of milling cutters or to invest in additional fixtures. This problem frequently leads to "nursing" along a set of cutters to avoid breakdown to such an extent as to diminish greatly the possible output of the machine. But losing output on a $5,000 machine to save tying up two or three hundred dollars in extra cutters, is a doubtful economy.

This is one of the problems that confront a shop manager and one that requires careful study. It is easy to think that refraining from buying standby equipment is an economy, but it is often an expensive method of saving money.

Old Army and Navy Ideas Still Rule

IN SPITE of the protests of aviators of both services at being under the direction of officers who have never even been in the air, and of widespread public opinion, the Army and Navy Departments have ignored everyone and refused to alter their organizations in any way. Even the moderate suggestions of the President's Aircraft Board, the recommendations of Congressional Committees and of the chief of the Army Air Service are calmly pushed aside. The only result is to capitalize the agitation to get more funds for the air service.

There is no quarrel with the increase of appropriation for the development of air service. But if the expenditures are to continue in the old way we are likely to be disapppointed in the results obtained. We may get a few more planes but we shall not have improved the organization and the cost of administration will continue to eat up far too much of the appropriation. Those who have followed the development of aviation feel that there is unnecessary duplication at present, and that both specifications and inspection need to be in the hands of men who know the practical side of the problems involved.

Progress or Die

EVERY so often some brilliant thinker rediscovers the fact that in this life we cannot stand still. We must either grow or die. There is nothing new in the principle but there are occasionally new applications.

Some one has pointed out that the agricultural machinery business reached a point of stagnation not so long ago because there had been no progress in design. When new and improved models were introduced business promptly revived.

There is a moral here for many builders of machinery. It is not necessary to specify which ones. If further proof of the validity of the principle is needed consider the machine tool builders. Up against a harder problem than that of any other type of machine builder they have kept constantly at the task of designing and developing new machine tools and have succeeded in staying alive under handicaps that would have smothered less progressive enterprisers.

Machinery on the Farm

THANKS largely to the use of mechanical equipment of various sorts, the American farm worker today cultivates about twice as many acres of land as did his grandfather fifty years ago. Figures collected by the National Industrial Conference Board show further that for the five-year period just before the war the average number of acres cultivated per worker was 24.4 in America, 16.6 in Scotland, 9.5 in England, 8.3 in France, 6.2 in Germany and 4.2 in Italy. In America the average use of farm machinery had increased in 1920 to five times the 1870 figure.

If the farmer is faring less prosperously than the industrial worker, as the Board's statements indicate, the reason apparently is not that he does not appreciate the value of farm machinery. There is nothing in the announcement to show whether machinery is being used to the extent it should be. Perhaps even greater use of it would help to solve his economic problems.

Almost every man is fitted for some job or other. When it turns out that a man doesn't fit the job he is hired for, why fire him and let it go at that? The man, you and the world would be better off if you took the trouble to find for him the job he fits—preferably in your own organization, but in another if necessary.

Shop Equipment News

Fitchburg Valve Grinding Machine

The Fitchburg Grinding Machine Co., Fitchburg, Mass., has brought out a grinding machine that has been especially designed to grind the face of poppet valves of the type used in automotive engines. The machine is built in two styles, one being driven entirely by electric motors and the other arranged to be driven by belt from an overhead shaft.

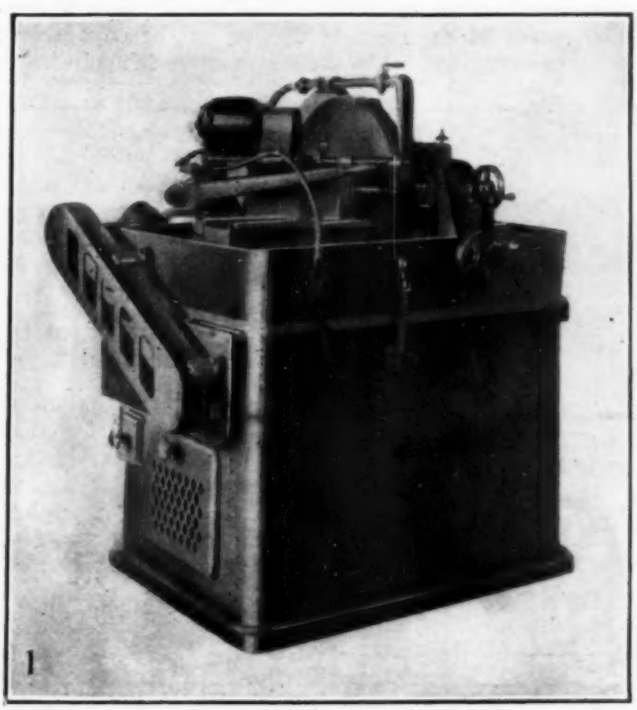
The motor-driven machine, a front view of which may be seen in Fig. 1, is self-contained; the main driving motor of 3 hp. being housed within the cabinet base. The belt-driven machine, of which Fig. 2 shows a rear view, differs from the other in no respect except that it is provided with pulleys and suitable guards for the driving belts.

The machine swings an abrasive wheel with a diameter of 18 in. and a face of ¾ in., upon a spindle that runs in tapered-sleeve bronze bearings that are adjustable to compensate for wear. The spindle bearings are both 5⅝ in. in length, and 2¼ and 2½ in. in diameter., respectively. They are mounted in a slide that has a limited range of movement in a direction at right angles to the axis of the spindle. This movement is brought about by a cam that is located in the gear box to be seen in the rear view of the machine as shown in Fig. 2.

The cam rotates slowly upon a vertically disposed spindle, one rotation of which constitutes a full cycle. The slide is advanced quickly to grinding position, advanced still further at a slow rate during the time of grinding, allowed to dwell for an instant, and then returned quickly to the starting point at which time the cycle is complete and the rotative movement knocks out automatically, or, when the operator has become sufficiently expert at unloading and reloading the work, may be allowed to run continuously.

The workhead, which may be seen to advantage in Fig. 1, is driven by a small independent motor of ⅓ hp., mounted directly on the head; or, in the belt driven machine, by a belt from the overhead countershaft. The angular position of the head is adjustable, and may be locked at angles of 30, 45 and 60 deg. with relation to the axis of the wheelspindle. The valve to be ground is held by its stem in a spring collet that is actuated by the long horizontally disposed lever, the handle of which is in position most convenient to the operator. The vertically disposed lever on the front of the cabinet stops and starts the cycle movement.

The workhead has a continuous reciprocating movement in a direction parallel to the axis of the main wheelspindle, regardless of the angular setting of the head. This movement is for the purpose of traversing the work across the face of the grinding wheel to avoid grinding rings in the face of the valve, and also to distribute the wear evenly over the face of the wheel. The range of this movement is adjustable. It is actuated by means of a yoke cam that is driven from the cycle movement of the machine and runs continuously.



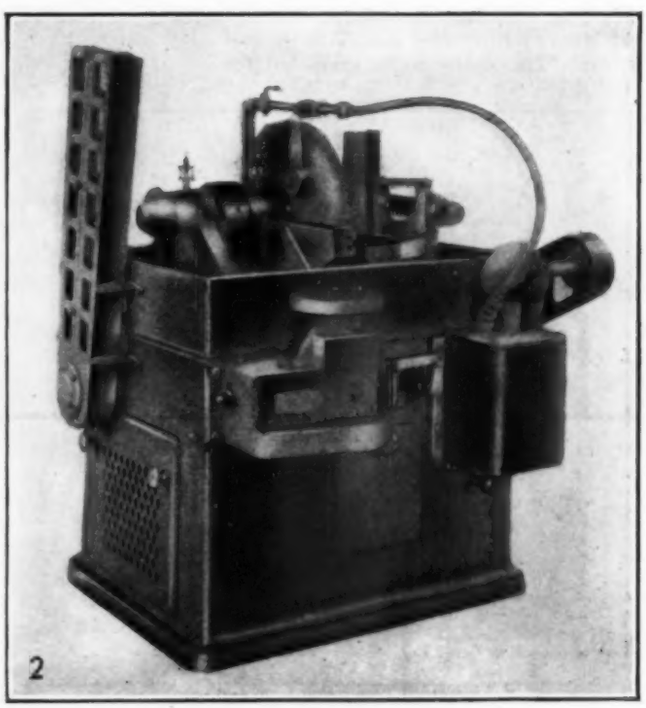


Fig. 1—Fitchburg Valve Grinding Machine. Fig. 2—Rear view of belt driven machine

Shop Equipment News

A small handwheel, the rim of which is graduated to read in 0.001 in. of work diam., advances the main slide in relation to the cam-operated movement of the latter. As the grinding wheel wears, it is advanced through a small increment and then the wheel is redressed before it is moved into position for grinding the next valve.

The position of the diamond truing device is fixed with relation to the work, so that advancing the wheel by means of the hand adjustment does not alter the size of the work being ground, provided the dressing follows the adjustment immediately. The truing device is, however, mounted upon the lower part of the main slide while the wheel itself is carried by the upper part, which is the part adjusted by the handwheel, so that the truing may be effected at any point of the cycle and without stopping the cycle movement.

The cam that actuates the cycle movement is at the top of the gear box, where it is guarded by an easily removable cover. It may be removed and another of different contour substituted for it in a few seconds. Change gears in the same box permit a rate of cycle movement from 4 to 8 per min. These and the change of cam provide for any change in the rate of feed that may be required for work of different sizes or of different material.

The machine is provided with a geared pump to circulate the grinding compound or cooling liquid, and the deep pan which forms the top of the cabinet base serves to guard against undue splashing. The floor space occupied by the machine is 45x45 in., and the net weight without the motor is 3,400 pounds.

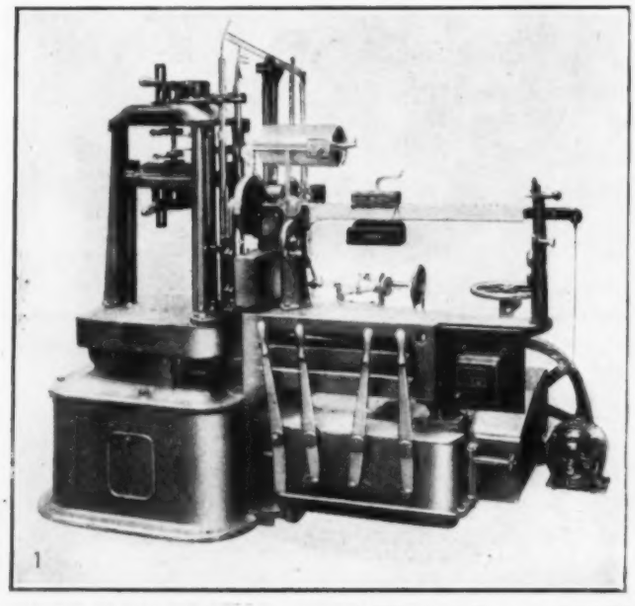
Olsen Universal Testing Machine Automatic and Autographic

The automatic and autographic universal testing machine shown in Figs. 1 and 2 is an improvement over a former model built by the Tinius Olsen Testing Machine Co., 500 North 12th St., Philadelphia, Pa. In Fig. 1 is shown the control side of the machine and Fig. 2 is a rear view. The machine is intended for determining the tensile, compression or transverse strength of materials.

The piece to be tested is clamped by means of two pairs of wedges operated by the two handles which can be seen, one above the column and one below the crosshead to the left in Fig. 1. The crosshead is drawn down or moved upwards by means of three screws which can all be seen in Fig. 2. The screws are rotated through gearing within the base of the machine.

The drive is through a gear box providing eight changes of speed. The gears are all mounted on ball bearings. The speeds are set by means of the four levers which can be seen in Fig. 1. By operating the left-hand lever, the crosshead may be raised or lowered immediately. A shifting of the three other levers will provide speeds of 0.05, 0.10, 0.02, 0.04, 1 and 2 in. per min. for testing the full capacity and speeds of 4 and 8 in. per min. for applying light loads and for adjusting the crosshead. These speeds are applicable in either direction by shifting the left-hand lever. The gear changes are arranged so that they can be placed in a neutral position to prevent locking the gears or causing damage when shifting the levers. The gears are entirely inclosed and run in a bath of oil.

The machine is operated by means of a constant-speed motor and silent chain drive. It can also be operated by hand by means of the handwheel to the right of the machine. The hand drive can be put into engagement by raising the small lever below the handwheel and it will operate through any of the gear speed ratios provided. The hand power attachment is thrown out of engagement when the power drive is applied.



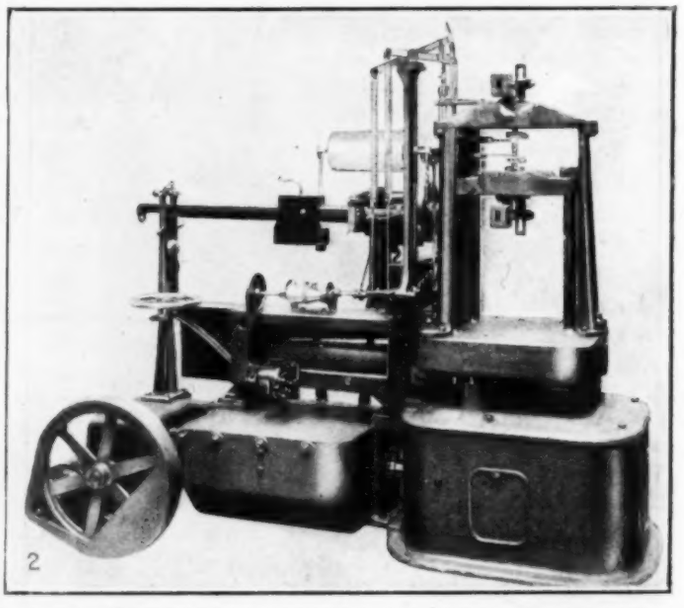


Fig. 1—Olsen Universal Testing Machine, Automatic and Autographic. Fig. 2—A rear view of the machine

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The load applied to the piece to be tested is balanced by the scale beam. The poise is moved farther along the beam by either hand or power drive. For hand operation the handwheel at about the center of the machine, as shown in Fig. 1, is used. For power drive, the small motor at the rear of the machine, as shown in Fig. 2, is used. The speed can be regulated by means of the cone speed-change device below the poise in Fig. 1. The belt between the two cones can be moved by means of the small handwheel to the right of the device. The poise is moved along the beam by the rotation of the horizontal screw parallel to the scale. Three poises are provided for use in making tension, compression and transverse tests.

The chart drum is rotated slowly during the test and a stylus is moved horizontally along a bar, according to the amount of travel of the poise used to balance the load on the piece being tested. The elongation or compression is magnified ten times, and the chart used is 10x20 in. in size.

The machine can be fitted with special columns and extensions to the weighing table for handling long tension members or columns in compression or long beams transversely.

Five sizes are being manufactured to handle various loads. Their weights range from 3,000 to 13,250 lb. and their load capacities from 30,000 to 200,000 lb. The clearance between the screws for compression testing ranges from 11½ to 23 in. while the machines are adapted for tensile tests on pieces of from 16 to 36 in. in length with 25 per cent elongation.

Morse Taper-Pin Reamer 3-Flute

The Morse Twist Drill & Machine Co., New Bedford, Mass., is marketing the 3-flute taper-pin reamer, illustrated. The flutes wind in a left-hand spiral and the cutting action is claimed to be fast and easy. Tests are said to show that only one-tenth as much torque is necessary to turn this reamer as for a right-hand spiral reamer and one-sixth as much torque as for a regular straight flute reamer. The spiral flutes give a shearing cut and facilitate clearing

Morse Taper-Pin Reamer, 3-Flute

of chips. The taper is ¼ in. per foot.

This tool can be furnished in either carbon or high-speed steel. It is made in nine sizes ranging from 0.119 in. in diam. at the small end for the size No. 0, to 0.398 in. in diam. at the small end for the size No. 8. The total lengths vary from 2¾ to 6¾ inches.

United Engineering and Foundry Co. Heavy-Duty Bloom Shear

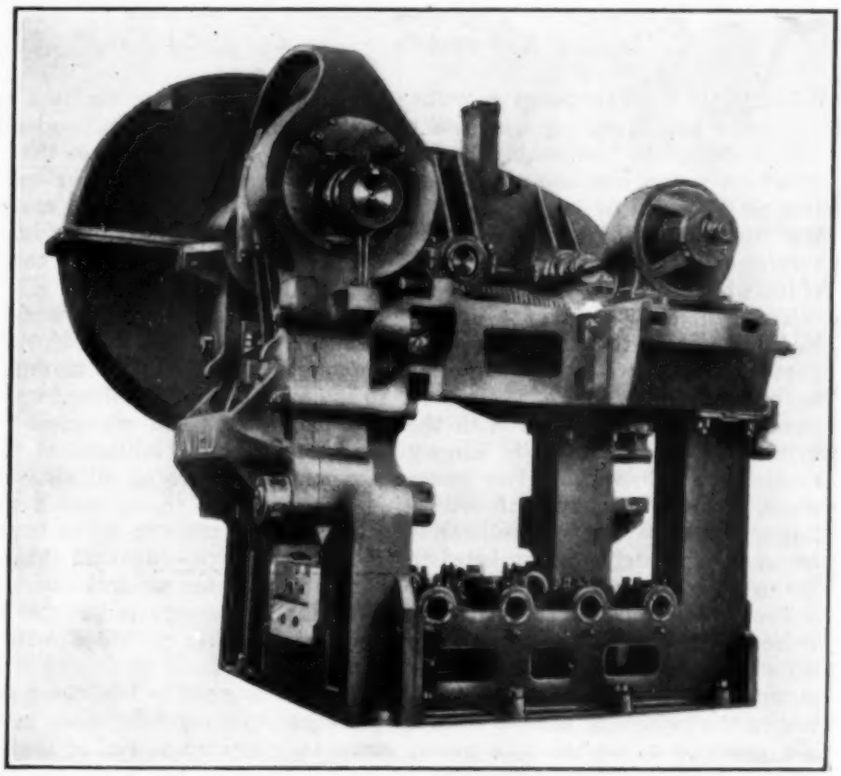
The United Engineering and Foundry Co., Pittsburgh, Pa., has built a large heavy-duty bloom shear shown in the accompanying illustration. The housing alone weighs 65,000 pounds.

The shear is driven by a 250-hp. motor and operates at a speed of twelve cuts per min. The maximum pressure exerted at the knives is 1,800,000 lb. and it is said to be able to cut a hot slab of 6x40 in. in section. By means of special knives and knife blocks the machine will shear hot blanks for 15-, 18-, and 24-in. I-beams.

All gears, the flywheel, and the stop-motion clutch are entirely inclosed. The gears, bearings and the clutch are lubricated by an automatic oiling system of the return gravity type. A non-knocking type of clutch that slides on spindles cut in the shaft is used. It is operated from a distant station by an electric pull-out device. This positive throwout feature that is essential on small shears is even more so on a shear of this size.

The knife-head has a spring balance designed to insure uniform pressure at all positions of the head. The stroke is 18 in. The front of the shear below the top is flush with the bottom knife. By means of this design the front of the shear is left entirely clear so that the sheared material, particularly crop ends, can be handled with ease.

Rolls are provided for carrying the stock to the knives. Only the bearings for these rolls are shown in the photograph of the machine.



United Engineering and Foundry Co. Heavy-Duty Bloom Shear

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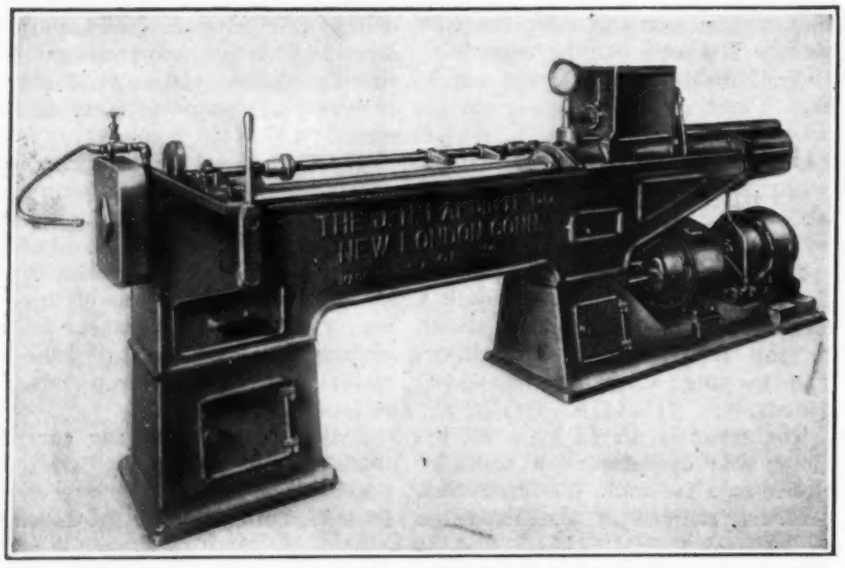
Lapointe Hydraulic Broaching Machine, 3-L

The J. N. Lapointe Co., of New London, Conn., has brought out the Model 3-L, improved form of its hydraulic broaching machine of which the 4-W was previously described on page 521, Vol. 63, of the *American Machinist*. The pressure for moving the draw-bar is supplied by a Hele-Shaw rotary pump of the variable delivery type. The pump may be driven by belt from any convenient countershaft, or, preferably, by a direct-connected, constant speed electric motor mounted on the base of the machine. A 7½-hp. motor is recommended for driving the machine which is illustrated.



Lapointe Hydraulic Broaching Machine 3-L

The cylinder is cast of a special hydraulic iron to withstand high pressures of oil without leakage. It is of 7-in. bore. The ports and passages are cast integral with the cylinder so that piping is largely eliminated. There are two short pipes, of heavy copper, in the circulating system. The control valves are cast separately and gasketed to the cylinder casting.

From the nature of the hydraulic drive any rate of movement from zero to a maximum of 24 ft. per minute may be imparted to the draw-rod on the broaching stroke. Means are provided to set the rate to any amount below this maximum as may be suited to the work in hand, and when so set, the rate cannot be exceeded except by readjustment.

The return stroke of the bar may be anything from 10 to 60 ft. per minute, depending upon the amount of opening given to the valve by the operator. The return movement is brought about by a separate internal tube which telescopes within the hollow draw-bar. Near the end of this tube the wall is perforated by a number of radial holes so that as the draw-head approaches the end of its stroke the oil in the tube escapes into the cylinder and thus releases the pressure so that the head cannot overrun its normal position.

The full length of the working stroke is 56 in., but an adjustable automatic stop limits the movement to any predetermined distance within the maximum. No wrenches are needed to make this adjustment. The maximum pressure of oil allowable is 1,000 lb. per sq.in., and a permanent relief valve is set to bypass the oil at this pressure and thus insure the machine against overload. The return pressure is but 240 lb., and this is also provided with a relief valve.

The oil is contained in the pump, passages and cylinder, and in an open tank located on top of the cylinder. There is never any pressure in the system except between the pump and the piston; the oil being merely transferred from one side to the other of the piston as the draw-bar moves, causing the level of oil in the tank to rise and fall in accordance with the difference in volumetric capacity of the cylinder before and behind the piston—the amount of oil displaced by the piston rod appearing in the tank as the draw-bar nears the outer end of its stroke.

Coolant for the broaching tools is supplied by a Brown & Sharpe geared pump that is belted directly to the drive shaft or motor. A tank in the cabinet leg at the left contains the liquid and provides means for straining and settling.

A feature of this machine is the removable chip pan, the handle of which may be seen in the cabinet leg to the left. The trough of the machine under the broach is so shaped that the chips and coolant flow naturally to this pan, through the perforated bottom of which the liquid drains to the tank. It is but the work of a moment to withdraw the pan and dump the accumulated chips into a convenient receptacle.

The draw-head is fitted with bronze shoes to slide upon a guideway in the trough of the machine, thus insuring alignment and minimizing wear upon the moving parts.

An extra attachment is provided to be bolted to the outside of the work-holding face plate for the purpose of supporting the overhanging weight of a long broach. A movable slide grips the outer end of the broach and guides it in alignment with the movement of the draw-bar until it is wholly supported by the work. This attachment is not included in the regular equipment of the machine but is available if desired.

Parker "Big Bear" Vise

The "Big Bear" vise is manufactured by the Charles Parker Co., Meriden, Conn., and is similar in construction to the "Hercules" model described on page 942, Vol. 62 of the *American Machinist*. The vise is provided with an anvil on the stationary jaw for the convenience of machinists. A setscrew and tension spring hold the handle of the vise in the position in which it is placed. It is designed with an outside saddle

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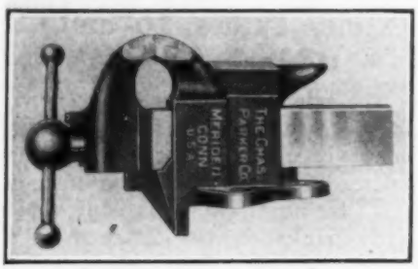
for the screw to facilitate lubrication. Its jaws are milled and pinned to the castings.

The vise is made in two types and two sizes in each type. They are made with 4- and 5-in. jaws to open 5½ and 6 in., respectively, and are provided with stationary or swivel bases. The swivel type can be clamped in any position around its

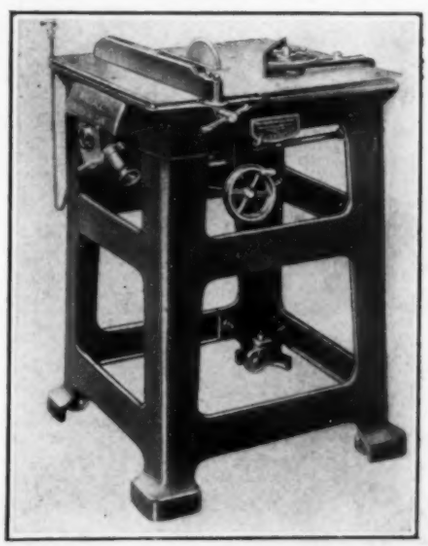


Parker "Big Bear" Vise

360 deg. of movement. The weights of the 4- and 5-in. stationary-type vises are 76 and 102 lb., respectively. The swivel-base vises weigh 89 and 112 lb. for the 4- and 5-in. sizes respectively.

Wallace Portable Universal Saw

A larger portable type universal saw has been brought out by J. D. Wallace & Co., Chicago, Ill. The No. 8 portable universal woodworking saw illustrated, is a factory production machine designed to relieve larger fixed machines in increasing production in mill departments or in the pattern shop, or for use in assembling or shipping rooms.



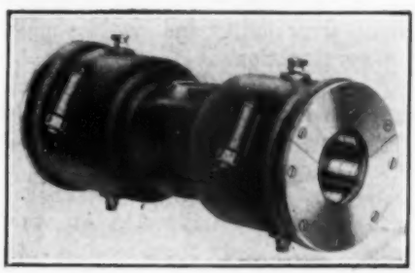
Wallace Portable Universal Saw

The table, which is of one piece, is made from finished steel 25 in. square. It has a capacity of 12x2½ in. between the blade and fence. It is designed for straight or angle cutting, either rip or cross cut. To cut angles the saw is tilted instead of the table. Right or left hand mitering can be done up to 50 deg. The saw is driven by a 1-hp. three-phase motor.

Hyatt Lineshaft Bearing

A split lineshaft bearing of dumbell shape, with roller bearing assemblies mounted at both ends is being marketed by the Hyatt Roller Bearing Co., Newark, N. J. It is designed for replacement purposes and the narrow center section allows the bearing to be inserted in plain bearing hangers of the narrower type.

The bearing assemblies are split and are of the new-series type recently adapted for high-duty bearings. It is claimed that the bars through each roller maintain equal spacing and positive alignment, and from a strong cage or retainer for the roller bearings.



Hyatt Lineshaft Bearing

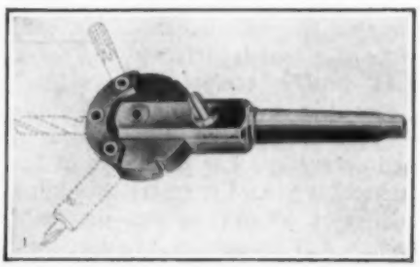
The box is built in two sections, the lower part forming two-thirds and the top, one-third of the assembly. This feature brings the joint well above the oil level and is said to prevent leakage. The sections are held together by four bolts, the bosses for which are staggered to prevent improper fitting.

It is claimed that the bearing can be placed in position in a few minutes and while the shaft is turning. Tests indicate that 15 per cent power can be saved. At present they are manufactured in five sizes, 1 7/16, 1 11/16, 2 3/16, 2 7/16 and 2 15/16 inches.

Maxwell Drilling and Boring Tools

A special three-tool holder for drilling operations and an improved boring tool are being marketed by the Maxwell Products Co., 7513 Indiana Ave., Cleveland, Ohio. The tools may be used on job work or for quantity production.

The former is called the M-P three-tool turret. As can be seen in Fig. 1, it operates on the turret principle



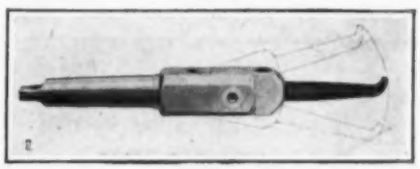


Fig. 1—Maxwell "M-P" Three-Tool Turret. Fig. 2—"E-Z-Set" Boring Tool

since the tools are successively indexed into position and locked in place with a pin. The tools shown in phantom are for centering, drilling and reaming, but other combinations may be employed. The holes in the turret are ⅞ in. in diam. The shank can be furnished with a straight diameter of 1 in. or a No. 3 Morse taper. The tool is intended to be inserted in the tailstock of a lathe, but it can as readily be used in a drill press when supplied with the Morse taper shank.

The "E-Z-Set" boring tool can be used in a drill press, screw machine, milling machine, or lathe. It can be adjusted, as shown in Fig. 2, to bore a wide range of holes. The adjustment is made by means of a worm and sector cut with a 10-pitch acme thread. The cutter as shown is supplied in either high-speed or carbon steel, or a special holder for an inserted cutter bit can be ordered. The shank is a separate piece and screws into the holder. No. 2 Morse taper, No. 7 B. & S. taper, or ¾-in. straight shanks can be had.

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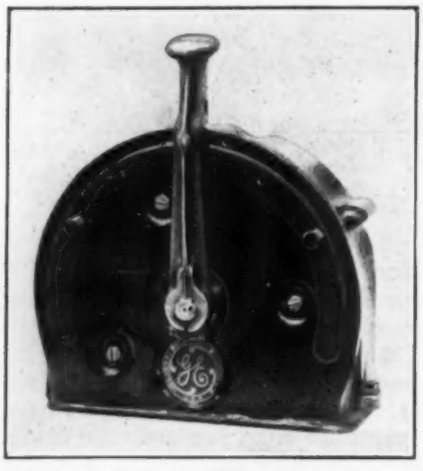
General Electric Master Switch

A lever operated master switch, illustrated, for steel mill service or other work where strength and durability are desired is being marketed by the General Electric Co., Schenectady, N. Y. The switch is suitable for grouping and for operation by one man. It has been designated C-3003 in the CR-3012 series of control.

The C-3003 master switch is semicircular in general shape and consists of a cast-iron frame and cover that totally encloses the contact mechanism. This design permits convenient grouping within reach of one operator. The handle is of the vertical type and operates through a radius of 40 deg. on the one-point switch and through a 100-deg. total radius on the three-point switch.



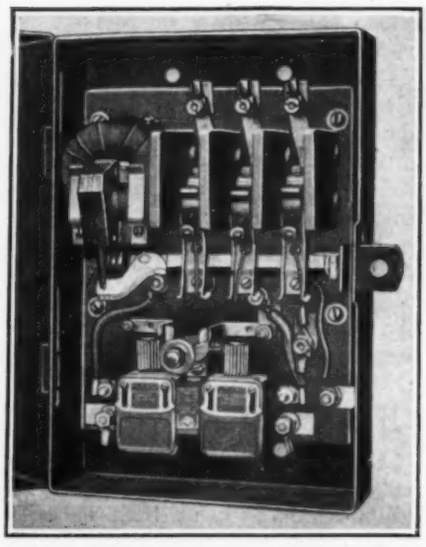
General Electric Master Switch

This handle is mushroom shaped for ease in handling. Operation from one position to another is said to be free, since there are no gears or other friction surfaces other than the bearings and the contact fingers. The handle is held in the "off" position by a spring roller device.

This switch is made in several forms, the C-3003-B being standard.

Cutler-Hammer Across-the-Line Starter

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has placed on the market an automatic starter for use in connection with a.c. motor drives of small and medium capacities. It can be connected directly across the line.



Cutler-Hammer Across-the-Line Starters

The bulletin 9586 C-H "X" starters are designed to provide for small size, ruggedness of the switch mechanism, a modern thermal overload relay, accessibility and low-loss magnet construction.

The starter is fully inclosed and employs a positive acting three-pole contactor, together with a thermal overload relay. It can be adjusted to individual motor loads. After the switch has been tripped by an overload it is reset by pressing a button. The contact fingers employed are accessible for inspection without the use of tools, and can be easily removed so that it is not necessary to take the starter out of the case.

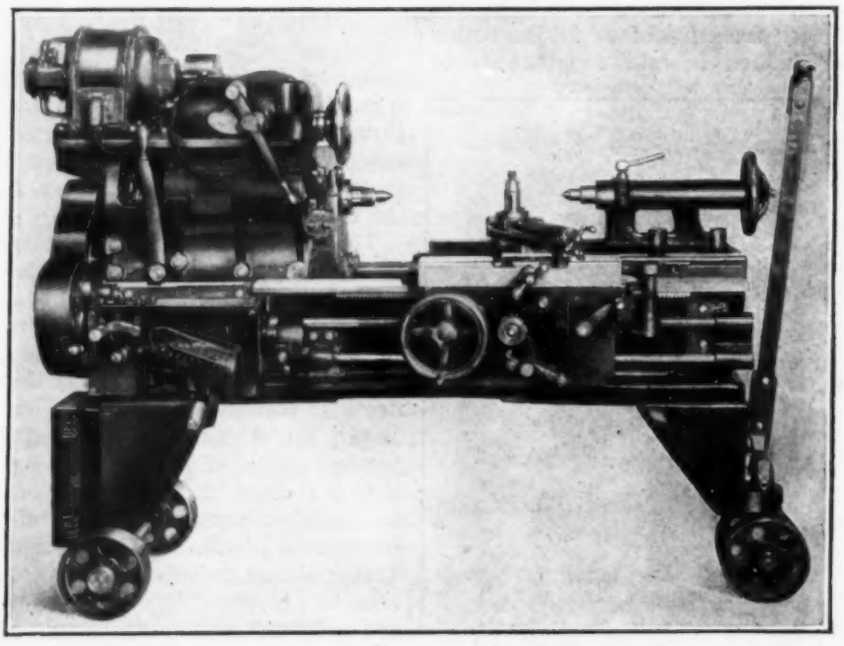
The starter can be adapted to varying ampere ratings by using the proper heating coils for each rating.

Rahn-Larmon Portable Engine Lathes, 16- and 18-inch, Series A

The portable engine lathe shown in the accompanying illustration is adapted especially for use in the railroad shop by the Rahn-Larmon Co., Cincinnati, Ohio. It is provided with four wheels, two of them on a swivel bearing. Ball bearings are used for each of the wheels.

The motor is mounted above the headstock and geared direct to the all-geared spindle drive. Nine changes of speed are provided for the headstock. The usual feeds are furnished on the lathe and a lever disengages the feed screw from the feed gears. The tailstock has a long bearing to increase its rigidity.

A 1-hp. motor is used to drive the machine. It has push-button control and reverse. Cord is provided for attachment to the regular power system of the shop. The lathe is built in 16- and 18-inch sizes and with beds 5, 6 or 7 ft. long as desired.



Rahn-Larmon Portable Engine Lathe, 16-Inch, Series A

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Hunter Metal Cutoff Saw High-Speed No. 1-A

The Hunter Saw & Machine Co., 5652 Butler Street, Pittsburgh, Pa., has placed on the market a new high-speed metal cutoff saw, model No. 1-A, designed for the cutting of light-section beams, channels, angles, brass, copper, as well as pressed and drawn steel shapes.

The circular saw is driven by an endless belt from the motor. The tilting frame which carries the saw arbor, and the motor, have been increased in size from the model No. 1, previously described on page 480, Vol. 62, of the *American Machinist*. The motor base will accommodate either a 7½- or a 10-hp. motor. The motor is keyed to the base to insure proper alignment of the pulleys and a handwheel is provided for belt adjustment. Both the belt and the saw are provided with steel safety guards.

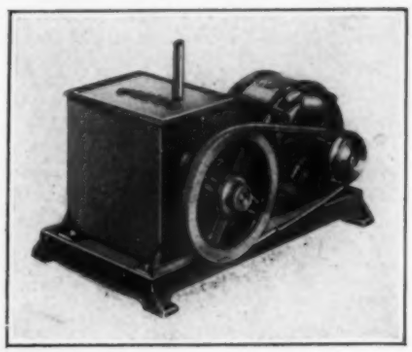
Hunter Metal Cutoff Saw, High-Speed, No. 1-A

The table has a quadrant stop that can be set to any angle within the range of the saw blade. The material is held by means of a double-jaw quick-acting eccentric vise. A push-button-controlled magnetic starter with low-voltage protection is also a part of the standard equipment furnished with machines having a.c. motors.

Using the maximum size of saw 24-in. in diam., the cutting capacity of the machine is 15x2½ in., 8x3 in., or 6x4 in. The speed of the spindle is 3,150 r.p.m. The floor space occupied by the machine is 31x39 in., and the weight with its 10-hp. motor and starter is 1,500 pounds.

Eisler "Midget" High-Vacuum Pump

The Eisler Engineering Co., 756 South Thirteenth St., Newark, N. J., is marketing the "Midget" single- and two-stage high-vacuum pump for laboratory use. The principle of operation is the same as for the large pump described on page 80, Vol. 61, of the *American Machinist*.



Eisler "Midget" High-Vacuum Pump

The pump, illustrated, is of the rotary type with the moving element placed eccentric to the fixed casing, which is larger in diameter. A single slot is cut entirely through the rotor and in it are placed two blades, forced outward by three helical springs. The blades sweep the wall of the fixed chamber and evacuate the air or other gas by positive displacement in the crescent-shaped space between the fixed and rotating elements. The two-stage unit, without backing, will exhaust to an absolute pressure of 0.001 mm. of mercury. A greater degree of vacuum may be obtained by backing the two-stage pump with the single-stage unit.

The pump is belted to a motor mounted on the same base. It operates at a speed of 425 r.p.m. and requires ½ hp. for the single-stage unit and ¾ hp. for the compound. The over-all dimensions of the complete unit, including the motor, are 11x17x10 in., and the weight is 70 lb. The pump itself weighs 32 lb. Both the single and the compound pump are housed in the same size box shown in the illustration.

Stevens Wheel Puller and Hub Re-Threader

A combination wheel puller and hub re-threader has been added to the line of "Speed-Up" tools made by Stevens & Co., 375 Broadway, New York City. The device is made in two sizes. The smaller one is adaptable to Ford and Chevrolet hubs and cuts 24 threads per inch. The larger is adaptable to all other makes of automobiles and cuts 16 threads per inch.

The device is self-contained. Three dies are provided and are adjustable so that threads can be cut on hubs of any diameter. The dies are guided in rectangular slots, and each has a pin that engages a special groove cut in a disk that acts as a cam. By turning the disk, all three dies are advanced at once and at the same rate. The rotation of the disk is controlled by a hand screw acting on a crank-pin. The nut is cylindrical in shape and adjusts itself to the position assumed by the screw as its end traverses the arc of a circle This construction can be plainly seen in the illustration. Once the dies are adjusted, the re-threading is accomplished by turning the die-holder by means of a monkey wrench applied to the square nut cast integral with the holder.

When used as a wheel puller, the dies act as clamps. The center bolt impinges against the shaft end and, when turned, it pushes the shaft out of the hub. Since the puller acts upon the hub and not on the spokes, no "dishing" of the wheel can occur. In order to prevent damage to the threads the nut of the driving bolt floats in the puller housing.

Stevens Wheel Puller and Hub Re-Threader

The large puller weighs 17 pounds.

News of the Week

Metal Trades Study Management Problems

Twenty-eighth annual convention of national body reports on industrial relations, education, foreman training, promotion of safety and prevention of accidents—Paul T. Norton elected president

STRESSING the importance of the foreman and of management as the connecting link between the employer and the employee, the principal speakers at the twenty-eighth annual convention of the National Metal Trades Association, held at the Hotel Astor, New York, on April 15 and 16, outlined and discussed various methods of foreman training and the relationship between good management and industrial development.

Reports of committees showed activity in the promotion of industrial and economic education, foreman training, industrial relations, improvement of the conditions and safety of employees and the prevention of industrial accidents.

Comparing the forces of production with the national army, John C. Spence, works manager of the Norton Co., said that we need better officers in our industrial army to be prepared for the competition which is to be expected from a rejuvenated Germany or England. Foreman training does not mean the creation of a Y. M. C. A. secretary or a social worker, but it does recognize that the foreman needs preparation for his job. He cited his own experience as an employee who was given a five-minute notice that he was to become a foreman and as having no training for the work that he was to do.

Buffer Between Departments

In order to meet the increasing demands and changing conditions in which we find ourselves, foremen must, for instance, know the safety requirements of the state, must be lawyers and business men. Automatic machines are being used to meet the shortage of labor caused by restricted immigration. Foremen must know what machines and what methods are the most productive. The good foreman reduces friction between departments, lowers the amount of labor turnover and of accidents, avoids the waste of time and materials, improves the quality of products, cooperates with the accounting and cost-keeping departments and promotes better organization spirit.

"How the American Multigraph Co. Handles Foreman Training," was the subject chosen by T. H. White, manager of industrial relations in this company. He recommended organized training as a means of correcting the lack of understanding between department heads. Closer contact through foreman meetings cures lack of harmony. Foremen conferences are found to increase morale and production and the understanding of each other's problems. The American Multigraph Co. organized a foremen's club which holds weekly meetings during working hours to hear an instructor or a member of the club as well as to discuss topics drawn from a bulletin published by the Department of Commerce. The club is self-supporting and self-controlled and maintains a club library. It maintains committees for promotion of good

Paul T. Norton

fellowship, for calling on the sick as well as for meetings and social functions. They learn to deal with management problems and employee representation as well as the proper handling of the human element. In answer to a question as to whether or not foremen resent obvious training, he said that the foremen co-operated in and invited the training. One company mentioned in the discussion which followed the talk by Mr. White, holds its meetings on company time and turns over to understudies the work of managing the departments in the absence of the foremen. It was pointed out that this encouraged the foreman to take into his confidence the employee and to transfer his knowledge of the problems to be met with. It was also brought out that the time to begin training the foreman is when he is an apprentice. He should be brought up right from the start. He needs to have sufficient knowledge to do things himself and to see that his orders are properly carried out. The foreman needs to be a manager and should be relieved of all red tape possible so that he can be an efficient manager. The suggestion was also made that the superintendent interview all the "quits" and ask point blank what they think of the plant. The answers were assured to make good topics for discussion in a foreman's meeting.

Industrial Insurance

A discussion of compensation insurance operations headed the program for April 16, the speakers being W. E. Odom, of the National Metal Trades Association; W. F. Herst, Wolverine Brass Works; Wm. Meyers, Bucyrus Co.; and Mr. Reese of the Pennsylvania Manufacturers' Association Casualty Insurance Co. Insurance companies organized by manufacturers and the methods whereby individual companies assume their own risk were discussed. In some states the direct assumption of risk by companies is permitted. Advantages claimed for the method are that the insuring company will have a broader interest in the accident case than will the usual insurance company. The claim was made that the insurance company has no further interest in the case of the injured employee than in the payment of the compensation. The manufacturer is interested in building up the good will of the community. He is interested in the rehabilitation of the employee and will go further than the regular insurance company in searching into the background of individual cases so as to assist most efficiently the employee who has been injured in his service. One organization cited in the discussion aimed to be so liberal to the employee that no lawyer could build a case against it in contesting the compensation paid to the employee. It found a saving in carrying its own insurance and assumption of risk and felt that the good will created would be sufficient to balance any loss which might arise.

Mr. Reese described the organization of the Pennsylvania Manufacturers' Association Casualty Insurance Co. The company was organized as a result of the high rates set by insurance

companies after the passing of workmen's compensation acts. Since the company carries no unusual risks and since it is operated at cost the rates are kept very low. Straight salaries instead of commissions are paid to its representatives and the company does not remunerate its non-productive labor. A similar organization in Grand Rapids, Mich., was also described. This company over a period of five years had only four contested claims and succeeded in two years time in reducing the accidents 30 per cent.

Following this discussion, the Hon. Ogden L. Mills, member of Congress from New York, made an intensive and forceful address on "The Real Tax Problem in the United States," appealing for an application of business methods to the operation of state governments as they had been applied to the federal government and pointing out the increasing danger in the practice of running the government on money borrowed under the bond system instead of on money raised by direct taxation. He also urged the foundation of research bureaus to investigate state financial conditions and to check unwarranted and wasteful methods of spending money.

John W. O'Leary, following this address, said that the problems of management are problems of production, labor, continuity of employment, finance, distribution and of unifying thought and effort.

Three-fold Responsibility

"The responsibilities of management are three-fold: First, to capital to see that an adequate return is made on the money invested; second, to labor to see that productive efforts of the individual workman are compensated for by adequate wages; and, third, to the general public to see that the price of the product is kept as low as possible and that the industry shall prosper in order that it may adequately serve and at the same time safeguard the national economic security.

"Our Federal Reserve System with resources of about 40 billion dollars, fundamentally, is not an institution of money but of management. Management, holding such importance in world affairs, must expect to be questioned concerning its contribution to industry.

"As a muscular process, labor does not differ greatly in effectiveness whether in England, China or the United States. Where applied to scientific principles of management and machinery, however, a great difference is immediately apparent.

"The tremendous development of primary horsepower per workman, the discarding of good machinery for better, the opportunity for the individual workman to earn in proportion to his production, the expenditure of vast sums for technical education, scientific research and experimentation, are management's contribution to production. This has resulted in the present high standard of living, together with a general reduction of working hours, and with a decrease of unemployment.

"Management has applied itself to the problem of securing co-operation on the part of the employee with the employer. It has also taken up the problem of maintaining continuity of employment especially in industries which would seem to be of a seasonal nature.

"Another contribution of management relates to the problem of finance. Your morning paper carries statements of managers as the basis for financing and operating industry. When, as sometimes happens, an industry gets into a bad way financially, management is transferred from the field of banking to the field of production. The fundamentals of management are applicable to either bank or foundry.

"Along with other problems of management has come the problem of distribution, which at one time, generally speaking, was in no way related to production. Now, the same man responsible for production as plant manager, has the added responsibility of distribution through agencies that directly represent or are in direct contact with the factory and, in many cases, are under factory direction.

"Our standards of living change for the better where management has full sway. Management realizes that we profit by the good of all and so effects team work between capital and labor. When the wage earner suffers, capital suffers too. In order to maintain the present position of American industry, we must take advantage of every agency for the development of men as managers schooled in the fundamentals which brought us to our favorable position, capable of preserving the achievements of today and meeting the demands which the future may hold."

Norton Elected President

Paul T. Norton, president of the Case Crane & Engineering Co., and formerly first vice-president of the National Metal Trades Association, was elected president of the organization. Harold C. Smith, president of the Illinois Tool Works, and formerly second vice-president of the association, was elected first vice-president. J. G. Benedict, president of the Landis Machine Co., a member of the committee on the Prevention of Industrial Accidents, became the second vice-president of the association; while J. W. O'Leary, president of Arthur J. O'Leary & Son Co., was re elected as treasurer.

The report of the retiring president Paul C. DeWolf, president of the Brown & Sharpe Manufacturing Co., which was read at the first session, contained the results of a survey, among the members of the association, concerning general business conditions. The total number of replies received to the questionnaires was 440. In answer to the question "How Is Business?" thirty-one reported that it was excellent. That business was very good was the report of 202 members; 186 reported that it was fair, while only 21 found that it was poor.

The second question, requesting a comparison of business with its condition six months ago, brought 193 replies that it was better, 198 that was just as good, while only 48 reported that it was not so good. It is interesting to note that a year ago 178 reported "better," 162 reported "just as good," while 106 reported "not so good."

The third question asked for a forecast of business conditions for the next six months. To this question 34 replied that they were excellent, 211 said that they were good, 190 that they appeared to be fair, while only 5 faced a poor future for the period. A year ago the predominance of the replies were that the business outlook was either poor or only fair.

To the question regarding the scarcity of labor, 156 reported that there was no scarcity, 142 reported that there was a scarcity of skilled workmen, 29 reported a scarcity of semi-skilled and common labor, while 113 made no reply. By way of comparison, a year ago 332 members of the Association reported that there was no scarcity at all, 101 that there was a scarcity of skilled labor and 12 that there was a scarcity of common labor. The report indicated a need for the further extension of training activities.

In order to ascertain to what extent efforts have been made to overcome the shortage of labor, the question was asked, "Do you train apprentices, operators, foremen?" Of 349 replies received, 240 train apprentices, 251 train their operators, 183 train their foremen, while only 91 did no training.

The convention closed with a banquet at which the retiring president, Paul C. DeWolf, presided. The Hon. Marcus Kavanagh, Chief Justice of the Superior Court of Illinois, spoke on the subject of "Lawlessness."

He pointed out the increase in crime in this country since 1850, and the decreasing percentage of criminals who are caught and pay the penalty of their crimes. The comparison with European countries, and with Canadian neighbors, was both uncomplimentary and disheartening. Much of this, in Judge Kavanaugh's opinion, is due to our form of laws, that have not been modernized as have those of other countries. This failure he attributed largely to the lawyers themselves and urged business men to be legislators that the desired change might be accomplished.

Judge Kavanaugh urged the teaching of respect for law in the homes, by example as well as by precept.

Foundry Trades Exhibition Planned for London

Plans are under way for the holding of an International Foundry Trades Exhibition at the Royal Agricultural Hall, Islington, London, from June 10 to 19. The exhibition will be held under the auspices of the Foundry Trades' Equipment and Supplies Association Ltd., representing the exhibitors, and the Institute of British Foundrymen, representing foundrymen of Great Britain.

In scope, the exhibition is intended to cover every type of raw material, plant and supply used in the iron, steel and non-ferrous foundry practice and allied trades. It is understood that the organizers are issuing invitations to all British foundries; to members of the Institute of British Foundrymen; to the British Cast-Iron Research Association; to European Foundry Technical Associations, and to each member of the American Foundrymen's Association.

Engineers and Scientists Would Propose Standardization of Electrical Apparatus and Technical Language for World Use

Twenty-second anniversary of International Commission

With a ten-day program dedicated to a sincere effort to establish a standard nomenclature for electrical apparatus and to the adoption of a common technical language to be used throughout the world, the twenty-second meeting of the International Electrotechnical Commission was held in New York last week. The first session was held in the Engineering Societies Building, with over one-hundred European delegates present. The convention was presided over by Dr. C. O. Mailloux, honorary president of the commission. The first session took the nature of a welcoming meeting, at which government officials and prominent engineers joined in a reception to the visiting guests.

The principal speaker was to be Secretary of Commerce Herbert Hoover, but he was unable to be present in person. He spoke a few words of welcome at Washington which were relayed by telephone and radio and broadcast to the meeting.

Promotes Good Will

Colonel R. E. Crompton, a British delegate, described the formation of the commission twenty-two years ago at the suggestion of Elihu Thompson. Colonel Crompton said the commission had been a great agency in the promotion of international goodwill. The international co-operation required for the progress of science and engineering, he said, was laying the foundations for a better understanding among nations.

The delegates came from seventeen European countries. At the pier the visiting electrical engineers were met by John W. Lieb, vice-president of the New York Edison Co., acting as chairman of the reception committee, and Frank W. Smith, vice-president of the United Electric Light and Power Co., chairman of the entertainment committee.

The progress of electrification in Russia was described by Professor M. Chatelain, chairman of the Russian Electrotechnical Council and vice-president of the Russian standards committee. Professor Chatelain is highly esteemed by the Soviet government despite the fact that he was an adherent of the overthrown political régime.

The discussion of the proposition to adopt a technical language for use among scientists, engineers and manufacturers of technical products resulted in the decision to proceed with a standardization program with this end in view.

The new language is to be a standardization of technical terms, a sort of technical Esperanto, that will enable scientists of all nations to communicate without reference to their native tongues.

The proposal was concurred in by delegates from Great Britain, France, Germany, Italy, Belgium, Russia and Japan.

The new language, Dr. Mailloux said, will be of special advantage to the United States because this country, controlling 50 per cent of the world's electrical industry, needs a medium in which to promote its interests abroad.

The task of formulating a standardized language for technicians was left to a special committee.

The international standardization conference being held in connection with the convention announced that the British and American delegates had agreed to standardize screw threads in order to make British and American types interchangeable for nuts and bolts. Sir Richard Glazebrook, of the British delegation said that such standardization would be a progressive step in industry.

C. E. Skinner presided over the conference on limits for fits at which representatives of Great Britain, Germany, Switzerland, Holland, Norway, Russia and Japan spoke. The use of unilateral tolerances was recommended and its use is growing. On the other hand there is a tendency in both Germany and Italy to use the shaft as standard instead of the hole, as in Great Britain and in this country. Some advocated the use of standard holes for small quantities and the standard shaft for mass production.

Both Germans and Swiss have several qualities of work for each class of fit, a point that was not considered necessary in formulating the American standards. The need for simple, graphical methods of presenting the different systems was brought out, the handicap of languages making it difficult to explain all the details without some such method.

The Russian engineers have, as a result of three years study, a proposed system outlined and expect to have it in shape for distribution, in several languages, in a few months. Japan is now using several systems, the American and German predominating. They have not formulated a system of their own as yet.

Temperature and size both affect tolerances and the need for considering both of these was clearly brought out. Larger work requires a different tolerance formula than the one found satisfactory on pieces under 10 inches.

A feature of the visit of the foreign members of the commission was a luncheon at the Engineers Club, of New York, tendered on April 15 by the American Engineering Standards Committee. C. E. Skinner of the Westinghouse Electric and Manufacturing Co., chairman of the A.E.S.C., presided and made a brief address of welcome to the delegates and to the chairman and secretaries of the European and Japanese standardization bodies, who were also guests.

Delegates from Austria, Italy, Czecho-Slovakia, Switzerland, Sweden, Russia and Great Britain responded in turn, presenting the greetings of their respective countries and expressing their pleasure at being present. Of considerable interest to all present was the statement of the Swiss delegate of his conviction that English should be the language of international standardization.

The meetings will continue throughout this week, after which the delegates will visit about the country in groups.

Industrial Leaders Tell How Engineers Can Qualify for Executive Positions

E. M. Herr says study alone is not enough

On the evening of April 14 at the Engineering Societies Building, in New York City, four prominent executive-engineers discussed the qualifications of engineers for high executive positions. The meeting was held under the auspices of the four founder societies of civil, mechanical, mining and electrical engineers. The large auditorium was filled to capacity.

The first speaker was E. M. Herr, president of the Westinghouse Electric and Manufacturing Co. He stated that executive ability is inborn and cannot be acquired; it consists chiefly of the ability to direct others. Hence study alone cannot fit students for future executive positions. Too much time is devoted by the colleges to purely technical subjects. A thorough training in the underlying principles of engineering is essential, but it should be supplemented by a well-rounded intellectual training, including the study of a foreign language and English for clarity in both written and oral expression of ideas. Extra-curriculum activities that develop qualities of leadership are helpful. High integrity is essential since the character of the executive is reflected throughout the organization. The true leader must forget his personal desires and sacrifice his all for the attainment of the aims of the organization. Unselfish devotion to work must prevail to the highest degree.

Bankers get the lion's share of the big jobs because they hold the purse strings; lawyers come next because of the complex laws that must be considered in handling administrative problems; engineers secure about their just portion of executive positions. Such is the opinion of H. A. Guess, vice-president of the American Smelting and Refining Co. He agreed with Mr. Herr that too much time is devoted by the colleges to technical matters. Mr. Guess suggested courses in accounting and cost figuring so that the proper economic point of view may be obtained. The human element should be stressed and a sympathetic under-

standing of the workers encouraged. Clear expression in both writing and talking is important and training in the open-meeting type of public speaking should be offered. Although the college courses should be broad, they should include two or three detailed subjects, the mastering of which will permit young graduates to go out and seek jobs and hold them in some subordinate position until the opportunity for advancement arrives.

As to qualifications Mr. Guess includes integrity, sustained energy, tact, basic knowledge of the industry, and lots of common sense. But no matter how able the executive, he owes his position to competent assistants and some lucky breaks. Shakespeare's famous line should be re-punctuated to read "There's a Divinity that shapes our ends rough, hew them as we will."

There is no simple formula for determining the fitness of a man for an executive position, according to Dr. Frank B. Jewett, vice-president of the American Telephone and Telegraph Co., General qualifications, however, should include character—an inborn heritage—and personality that is so closely allied with it. The latter quality impels respect and following as a leader. Attitude of mind should include imagination, initiative, and the will to go ahead. Big business with its functional specialization involving engineering problems requires that the leaders should be versed in science and engineering. It is obvious that only a portion of engineers can attain executive positions, but Dr. Jewett believes the percentage is high compared to other groups. Adopting the point of view of the executive who is looking for a successor, Dr. Jewett has made a conscious effort to pick likely men and to shift them about in the organization so as to build up an executive reserve. This shifting has not been confined to detailed engineering work alone, but has also covered some general business training and particularly work that involved the handling of men. He stated that his own experience led him to believe that an executive must appraise the engineering values of the problems under consideration and that in order to do so he must be a good engineer, well grounded in the fundamentals of the profession.

Blame Themselves

Believing firmly in the eternal righteousness of things and that, if the qualification exists, the opportunity of using it will eventually arrive, J. C. Parker, vice-president and chief engineer of the Brooklyn Edison Co., concluded that engineers have only themselves to blame for not having attained high executive positions. He accuses engineers of becoming so absorbed in technique that they fail to recognize the broader aspects of a problem. To be successful an executive should be familiar with general engineering principles. The scientific habit of thought should be intuitive. The differentiation between fundamentals and superficialities is paramount, since decision results from the ability to generalize from the particular to the broad issues.

Executives should be socially minded, a qualification that can only be attained by intimate contact with individuals, not by a mere act of will. Kindliness in everyday life, faith in subordinates, customers and others always pays since most men respond in the spirit with which they are met. Mr. Parker concluded with this remark: "Let the executive be a man and work at it."

Others spoke informally. E. M. Rine, vice-president and general manager of the Delaware, Lackawanna & Western R.R. stated that engineers move around a lot in technical work but rarely land in executive positions. He attributed this condition to the fact that it is hard to get men to go into work with which they are not as familiar as their old jobs. Some men have to be forced to make a change into broader lines.

Activities of A.S.M.E. Management Division

The management division of the American Society of Mechanical Engineers recently announced its policy and a 10-year program of activities. In general, the division will devote its energy to those problems that involve the control of human forces in industry. The policy will be to produce timely papers by the best authors and to give backing to their acceptance; to discover and encourage writers from every locality; to carry on investigations or to stimulate interest in matters of importance to management; to act as a clearing house on good practice; to assist local branches of the division or individual members; to co-operate with similar societies; and to promote engineering education for managers.

The general program for the next ten years includes further investigation of preferred numbers, a subject for which prospective authors are now being sought. A re-statement of Professor Roe's paper, "The Measurement of Management" is being worked up for purposes of application, and managers will be persuaded to try out the formulas given. A comprehensive survey of economical lot sizes is being planned. A study of management terminology is being pursued by four eminent engineers.

A production control session is planned for the 1926 annual meeting and a continuous effort will be made to obtain and publish papers on typical production control in the basic industries. The best examples will be recommended as good practice. The investigation of fatigue is to be pushed. Literature on the importance of safety work is to be disseminated and current data on safety standardization will be published monthly in the *A.S.M.E. News*. The division will also assist the U. S. Department of Commerce and the American Engineering Standards Committee in their campaign to increase standardization of parts and simplification of styles, varieties and sizes, and will encourage the use of clearing houses in each trade group for information regarding standardization.

Besides the bodies mentioned above, co-operation and joint meetings will be had with the Taylor Society, Society of Industrial Engineers, American Management Association, National Management Week Committee and the American Engineering Council.

Fort Wayne and Montreal Get A.S.S.T. Charters

The first charter for a new group of the American Society for Steel Treating since the admission of San Francisco some two and one-half years ago, was issued to the city of Fort Wayne, Ind., at a preliminary organization meeting held on March 13 at Fort Wayne. The following officers were elected: Chairman, G. E. Tibbetts, factory manager, the S. F. Bowser Co.; vice-chairman, E. H. Shoner, assistant superintendent, the International Harvester Co.; secretary-treasurer, Arthur L. Cramp, past-chairman of the Indianapolis Chapter and at present machine foreman of the International Harvester Co. The following were elected as members of the executive committee: Chas. Grimes, heat treating foreman and F. A. Newman, heat treater of the General Electric Co.; J. Hentzler, toolroom foreman and C. Frauenfelder, the Tokheim Oil, Pump and Tank Co.; W. P. Burt, factory superintendent and George Friess, toolroom foreman of the Wayne Tank and Pump Co., and John A. Hanson, chief tool designer and M. E. Langdon, foundry general foreman of the S. F. Bowser Co.

The first regular meeting of the new group was held on Thursday evening, April 1. There was an attendance of over 100 to witness the moving pictures on the manufacture of alloy steel, presented by S. A. Richardson, research metallurgist of the Interstate Iron and Steel Co. Mr. Richardson prefaced the moving pictures with a practical talk on the various methods of the manufacture of steel, explaining in detail what constituted the various grades as well as the effect of different alloying elements.

Stansfield Heads Group

Over 40 individuals representing 28 metal-working firms petitioned the board of the American Society for Steel Treating for a charter for a Montreal group. The national secretary attended the organization meeting on April 7 held at Mt. Royal Hotel.

It was decided to elect temporary officers and the following organization was perfected: Chairman, Dr. Alfred Stansfield, associate of the Royal School of Mines, Fellow of the Royal Society of Canada and Professor of Metallurgy, McGill University, and the author of the "Electric Furnace for Iron and Steel"; vice-chairman, Chas. F. Pascoe, metallurgist, the Canadian Car and Foundry Co., and the Canadian Steel Foundries; secretary-treasurer, Fred H. Williams, assistant engineer of tests, Canadian National Railway. The following were elected members of the executive committee: Robert Job, vice-president, the Milton-Hershey Co.; D. C. Slimping, industrial engineer, the Montreal Light, Heat and Power Co.; W. W. Townsend, tool supervisor, the Montreal Locomotive Works; Robt. J. Noaks, superintendent, the Canadian Pneumatic Tool Co.; H. S. Weldon, metallurgist, the Canadian Inspection and Testing Co.; Gordon Sproule, assistant professor of metallurgy, McGill University; and W. J. Hall, Production Materials, Ltd.

French Industry Retarded by Financial, Political and Taxation Problems

Customs tariff law is expected to produce revenue

BY OUR PARIS CORRESPONDENT

Changes in cabinets and finance ministers are bringing nothing but new financial problems which the French manufacturer, importer and distributor alike must face. This demands a new régime of business, and without doubt, a general increase in prices throughout. The machinery and metal transforming trades are likely to be as hard hit as any other.

It matters little whether it is called a production tax or a sales tax, but the chief measures of the new finance bill which finally passed the Chamber of Deputies this week, and is now in the senate, are going to strike to the heart of things all along the line and bring in their wake a further high level of prices. The consumer will finally pay the bill, perhaps from 10 to 20 per cent more than the ruling price list of the past year. The falling franc has done little to assure the public of any immediate relief. Franc stabilization is something still remote though booked for discussion during the present legislative session.

PROTECTION FOR MACHINERY

The new customs tariff law which has passed the deputies is expected to produce an increased revenue from that source of half a million francs as a result of the revision upward of 30 per cent. In the debates machinery, tools and agricultural machinery were specifically mentioned as demanding this increased protection.

The government is proposing also a gasoline and petrol monopoly and the automobile industry and that manufacturing motors using fuel oil are protesting. Likewise big and little industry is protesting against Monsieur de Monzie's proposition for the nationalization of French mines. Coal and iron, to mention but two basic necessities, once in government grip and free from competition will carry price inflation another notch upward to the utmost limit that the daily life of the people will stand.

The Associated Electrical Industries are petitioning the government that the State buy only French products for all public works and is one of the industrial elements which asked for increased tariff protection. The associated members of this close corporation have adopted the national trade-mark "Unis-France" which shall make known French products in world markets.

A sidelight on French manufacturing costs is that manufacturing industries in the Paris district have experienced an increase in the cost of electric power of another 15 per cent, making a 50 per cent increase since 1922.

A projected steel rail combine is in the air, composed of French, British Luxembourg, Belgian and German makers, leading to a hoped for definite agreement as to sales in world markets. A final conference is to be held soon at either Berlin, London, Paris or Brussels when the details will be made known.

French exports to Italy are receiving hard blows from German competition in the tool and machinery line as well as electrical appliances.

Just how French finance is affected by purchases abroad is shown by reference to the import figures of 1925 when "raw materials necessary to industry" were brought in to the value of nearly 30 billion francs, all presumably paid for in dollars or sterling. In the first two months of 1926 such imports increased in value over those of the same period in 1925 by more than 50 per cent. With present ruling exchange rates it is estimated that the latter imports cost 20 per cent more than last year. Production costs, to say nothing of specific overhead and wages, are steadily rising and will soon reach the limit of possibility if the country, or for that matter foreign markets, are to absorb the output.

There is a shortage of wire in the French market, due, it is claimed, to increased exports. The wire nail industry finds itself in a like situation. Building hardware is finding a slightly increased demand and the stamping presses of the Ardennes are getting a normal business after the lagging of some months past. French makers had been hopeful of participating in the orders of the Spanish government for 250 locomotives, but late reports indicate that the orders were given entirely to Spanish plants. There have been a few small orders for locomotives and rolling stock for French railways and those of the Eastern colonies during the past month.

Imports from the United States the present year have averaged seven hundred million francs a month while exports thereto have hardly reached three hundred millions. Exports and imports with relation to Great Britain have about balanced. Germany has increased her exports to France while French exports to Germany have fallen off one-half from what they were during the same period a year ago.

There appears to be a waiting period in any labor manifestations in favor of wage increase, though there have been some local disturbances during the past month. Any notable increase in living costs as a result of the new finance bill's provisions will unquestionably bring an increased wage demand in metallurgical and transforming lines. The communist agitation for increased wages will then bring its fruit with possibly a serious setback in many branches of the metal manufacturing trades. A combined protest was made by the workers in the metal trades in the Paris district on April first at the instigation of the workers' association. It is purely a question between employer and employee but the government labor bureau is especially concerned as to what may be the final outcome.

Judgment in a patent case in the Paris courts has decreed that an American firm owning a French patent must work it in France within a reasonable time, regardless of what material difficulties may be encountered, or the patent will fall into public domain. If this interpretation gains ground it will be of far reaching effect. The decision, following conformity with the law, might have been expected but dormant French patents held by foreigners are manifestly seriously affected.

Japan Faces Industrial Crisis if Silk Market Fails to Respond

Iron and steel trades wrecked by internal strife

BY OUR TOKIO CORRESPONDENT

Depression continues in Japan's industrial circles, the slump which began in 1920 remaining unbroken. From Jan. 1 to Mar. 20 the volume of foreign trade was Yen 1,080,234,000, a decline of Yen 54,650,000 from the corresponding period of 1925. A slight increase in exports and a marked decline in imports, however, cut the visible unfavorable balance Yen 113,620,000.

In December stock operators forecast an industrial boom and endeavored to start a bull market. The remarkable rise of the yen-dollar exchange rate, however, upset their predictions. This advance, which took the rate from $42 to $46¼ in less than three months, lowered commodity prices to a point where they were unprofitable. As a result, the boom ended in February and stock quotations have been easing off, now standing slightly below their level at the first of the year.

Cotton yarn, which late in November was quoted at Yen 305, stood on March 20 at Yen 240.10 per bale in the Osaka spot market. Due to the fact that spinners contracted for their raw cotton from India, Egypt and America last summer, before the yen staged its spectacular advance, they are now forced to market their products at a loss which they claim to be in the neighborhood of Yen 35 per bale. Another unfavorable factor is the suspension of the 3 per cent cotton consumption tax in India, which is one of Japan's best markets. During the calendar year 1925 India used 162,000,000 yds. of Japanese cotton cloth, while her annual consumption of Japanese yarn is in the neighborhood of 55,000,000 lb. The recovery of the Chinese treaty port mills, notably in Shanghai, is expected to displace Japanese cloth and yarn from some of the markets which they enjoyed in 1925.

Silk is in a similar position. Last

summer and fall the filatures laid in heavy stocks of cocoons at the high prices then prevailing. The rising yen-dollar exchange has taken the bottom out of the market, assisted by a declining seasonal demand from New York. Spot raw silk, which sold in Yokohama for Yen 2,030 at the end of 1925, is now being quoted at Yen 1,699. Reelers claim that this price entails a loss of about Yen 200 per picul. As a result, many small filatures throughout the country are closing down until they can buy cheap June cocoons and in some measure recoup their losses.

The steel trade is in poor shape and representatives of the leading plants are endeavoring to form a combine, with government support, for joint purchase and sales. The Hangyehping Iron and Coal Co., of China, which has been supplying the government steel works at Edamitsu for the past several years, has been forced into a practical suspension by strikes. The concern is under contract to supply 300,000 tons of ore and 250,000 tons of pig iron annually. During the fiscal year of 1925-26, which ended April 1, it was unable to supply but 16,000 tons of pig iron. Other Manchurian plants are in the same predicament and the government works are reported running short of raw materials.

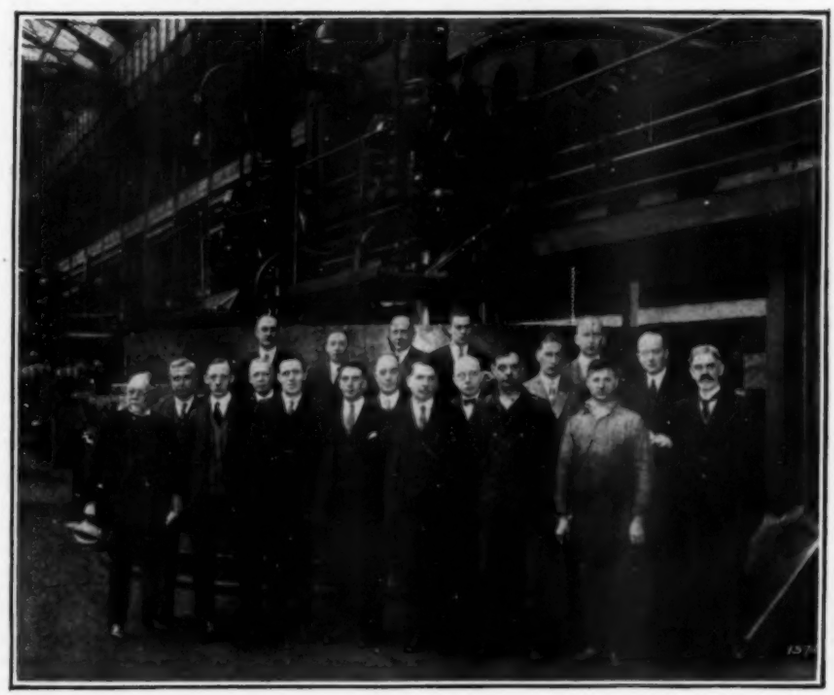
Flour millers have been adversely affected by the rising exchange, the recovery of the Shanghai mills and other factors. In anticipation that the tariff on wheat would be increased by more than 100 per cent, however, they placed heavy orders for delivery before the beginning of the new fiscal year, when the law is expected to take effect. There is some doubt regarding the passage of the measure, however, as the House of Peers is raising objections to the draft sent up from the Lower House.

Conditions, on the whole, are just about as poor as they could be. There are signs, however, that the next few months will see a marked revival, if the American market for silk continues strong.

Secret File for Patents

A secret file for patents essential to the national defense is proposed in a bill which has been introduced by Chairman Morin of the House Military Affairs Committee. When in the judgment of the Secretary of War or the Secretary of the Navy the publication of an invention would be prejudicial to the national defense, the patent is to be sealed. Where the patentee is not a government employee his consent to this action must be secured.

British Trade Union Students in America



Group of British trade union representatives sent to this country by the Daily Mail, *of London, to study American production methods. This picture was taken during a visit of the delegation to the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Company*

The personnel of the group includes:

Front Row, left to right: Grant Green, Westinghouse; Samuel Ratcliffe; William Wareing; E. S. McClelland, Westinghouse; T. J. Kay; C. Wilkinson; J. H. Priest, Westinghouse; Alexander Browning; Alexander Christey, Westinghouse; C. J. Ramsey, Metropolitan Vickers Co.; Fenton McPherson, London Daily Mail.

Rear Row, left to right: C. Hays Long, Westinghouse; Thomas Murray; P. E. Henninger, Westinghouse; R. P. Stacy, Duquesne Light Co.; D. B. Charters, Westinghouse; Sir Percival Phillips, London Daily Mail.

Resolution Would Put Metric Responsibility Up to Hoover

In view of the disinclination of the House Committee on Coinage, Weights, and Measures, to report out the Britten Metric System Bill, an alternate proposition has been brought forward in the form of a resolution providing that the Secretary of Commerce "initiate and execute plans whereby metric weights and measures may be brought into common use in commerce and merchandising."

The committee, after having listened to extensive argument from the proponents and opponents of the metric system, apparently was prepared to vote down decisively a motion to report the bill favorably. As a consequence the matter never was brought to a vote. A sub-committee was named to select from the vast amount of documentary material submitted, that portion which could be printed as a part of the Record without making it too voluminous. This work has been done and printed copies of the testimony and many of the briefs and documents will be available in the near future. The text of the proposed resolution is as follows:

Whereas, there is in the United States a deplorable lack of uniformity in weights and measures; and

Whereas, metric weights and measures are decimal, logical and easy to learn and work with; and

Whereas, this system is generally accepted for international use and has been adopted by the vast majority of enlightened nations; and

Whereas, the States of California, Illinois, Tennessee, North Dakota, and Utah have memorialized Congress to enact metric-standards legislation, and there is evident a nationwide desire to secure the advantage of the common use of a world uniform system of weights and measures; now therefore, be it.

Resolved, by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of Commerce be, and he is hereby authorized and directed to conduct a survey to determine the advantages of the gradual introduction of metric weights and measures through investigation where actual application of this system has been made, time involved, results obtained, and actual value of results; and further, be it

Resolved, that the Secretary of Commerce, initiate and execute plans based on the findings of the survey, whereby metric weights and measures may be brought into common use in commerce and merchandising. The terms "world yard" for meter, "world quart" for liter, and "world pound" for 500 grams to be recognized and permitted; and further, be it

Resolved, that the proper teaching of metric weights and measures be encouraged, and gradually given precedence in the schools; and that steps be taken to effect the early complete use of metric weights and measures by the departments of the Government.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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A VERY broad and inclusive view is necessary to an intelligent interpretation of the present business outlook. The stock market is still in the throes of a secondary but intermittent liquidation. Heavy losses have been incurred in some quarters and the losers are naturally discouraged. Their distress makes them pessimistic and the emanations of their pessimism have caused more or less depression in lines of business where profits are dependent upon the demand for luxuries or semi-luxuries.

But there is nothing to indicate that America's consuming power has been seriously impaired, nor can it be truthfully said that distributive trade in essentials has been much affected.

In the dry goods market there are complaints of a slack demand for cotton fabrics, and some of the mill agents have gone South to consult with the manufacturers as to whether a curtailment is desirable. The result of the conference is not known at this writing, but, as the market for raw cotton shows great stability and our domestic consumption for March was the largest on record, it is doubtful whether the mills will agree to any drastic reduction. In the other departments of the textile industry normal activity is reported. Woolen goods are moving about as usual at a slight reduction in prices, and the demand for silk and rayon products is, if anything, better than usual.

As this is written May wheat is up about 8 cents a bushel for the week. The buying has come chiefly from the shorts, who are alarmed at the strength of the statistical position and predictions of an abnormally small carryover.

Sugar is distinctly higher upon the news that the Cuban government has recommended a voluntary curtailment of 10 per cent in this year's output and that measures will be taken to prevent overproduction in the future. The coffee market is still under the shadow of government price control, and the only buying comes from consumers who take what they need from day to day. For this reason it is difficult to lift prices and no advance of importance seems likely. Rubber has been very weak. No one seems to know just why, but it appears to be a case of speculative liquidation.

Reports from the steel industry are just a little less optimistic, and the decline in pig iron seems to have foreshadowed a reduction in the demand for steel products.

Building activity is unabated, but the work now being done is upon buildings that were planned some months ago, and as rents are tending downward a slight decline in new construction may be witnessed during the summer.

When the stock market was not declining it was quiet, and it is plain that no revival of speculative activity may be expected for some time; but the buying of "odd lots" for investment account has been enormous, and it is evident that there are many people who have plenty of money to invest in the securities that appeal to them. The same thing may be said of the bond market, where the investment demand for well seasoned bonds is impressive and has slightly advanced prices. The weekly statement of the Federal Reserve Banks shows no changes that are important. A reduction of 1.6 per cent in the reserve ratio is explained by an increase of $78,000,000 in earning assets and a gain of $97,000,000, in circulation and deposits.

The report of the Department of Commerce upon our foreign trade for March is probably the most important news of the week. The excess of merchandise imports over exports is valued at $70,000,000. In the same month last year the balance was $68,000,000 the other way. The total excess of merchandise imports over exports for the first three months of the year amounts to about $125,000,000, and unless there is an unexpected increase in our exports the so-called favorable balance for the calendar year will be very small.

Our imports of gold during the month of March also exceeded our exports by $39,000,000, with the result that our total supply of monetary gold reached $4,495,000,000 on the first of April. This compares with a record total of $4,570,000,000 established in 1924.

These figures are worth very careful study as they reflect the fundamental change in our economic situation that is inevitable now that we have become a creditor instead of a debtor nation. The increase in our gold supply will of course provide a basis for a further expansion in bank credit, and the result may be more or less inflation in the commodity markets.

But as against this there is to be put the psychological effect of what is mistakenly called an adverse trade balance and the demand that the farmers are making for a reduction in the tariff upon the theory that the duties imposed under the Fordney-McCumber bill unduly increase the cost of living in this country and also makes it difficult to sell our surplus production abroad.

The politico-economic question involved in the issues thus outlined is likely to occupy the attention of the public from now until next November, when the Congressional election is to be held. The effect may be more or less uncertainty and hesitation, for an adverse trade balance and a reduction in the tariff have never been counted upon as business stimulants in America. Perhaps our national attitude toward these matters may be changed as our knowledge of economic fundamentals increases, but the educational process is a slow one and it will take time to convince the American people that we must buy more than we sell when the whole world is indebted to us.

What's Doing in Industry

The month of April has developed a condition in the machine tool and machinery industry that can best be described as spotty. Reports from several important industrial centers vary to such an extent that a hard and fast analysis is difficult. It might be said, however, that sales have slowed up, but that inquiries indicate only a temporary lull while production schedules are being revised.

The most recent bulletin issued by the National Machine Tool Builders' Association shows a decided turn *upward* in the curve of sales in March. This is indisputable evidence of sound business conditions in this industry.

The market last week was rather inactive. Detroit sales declined when automobile manufacturers curtailed production schedules. Chicago reported a slight improvement in the general tone, though little in the way of new business. In Cincinnati the railroads and industrialists have come into the market for a few tools.

The New England territory shows the biggest improvement, shops being busy and working schedules in process of expansion. Canadian industries, especially the steel and construction branches, are buying equipment for current projects. Inquiries in the New York market have increased. The South reports considerable activity, though actual sales have fallen below the expected volume.

There is nothing in the present situation to indicate that America's consuming power has been seriously impaired, nor can it be said that distributive trade in essentials has been much affected by recent events.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Indianapolis

A little more activity was shown in the past two weeks in machine tools and machinery business. Business remains a little spotted, however, but this condition is believed to be temporary in view of an increasing number of inquiries. Most of the business seems to be for replacements.

With better weather, contractors' equipment is moving more readily. There is a fair volume of inquiry from railroads, but the actual buying remains restricted in this state. The automobile factories continue to buy steadily, though the volume is not as large as it was. Production is being maintained, however, in two of the largest local factories.

Dealers of used machinery report a better demand. Sales to coal mines continue slow and likely will remain so until fall. Farm implement factories are doing some buying. Sales to lumber factories are somewhat larger, but sales to furniture factories continue below normal for this time of the year.

Detroit

Declining sales of machine tools and machinery in Detroit, and in other industrial centers of southeastern Michigan such as Flint, Pontiac and Lansing, have brought local representatives of machinery manufacturers face to face with a condition which had not been expected for some months.

The exceptional activity in the Detroit area during the latter part of 1925 and even during the first two months of this year led some to hope that 1926 would be another banner year. This belief is somewhat weakened because of the curtailment of expansion programs scheduled by a number of the leading automobile plants.

The decided reaction on the part of automotive executives and dealers throughout the country to the long-time payment of motor cars has affected production in Detroit plants, and orders have been issued by more than one manufacturer to cut down on purchases.

As one leading machine tool dealer described it "things are more quiet than they have been for the past six months." The remainder of the first half of the year is likely to remain quiet unless something unforeseen happens. The backward weather this spring has affected automobile sales, and as a consequence the market for machine tools and machinery.

Employment, however, remains at a high mark, and this would apparently forecast the bettering of present conditions before many weeks.

Chicago

Business in machine tools, while not quite up to expectations for April, is showing some improvement. As compared with the first two weeks in March, a slight falling off in the volume of trade is the experience of most dealers. There are indications, however, that the increase in activity generally noted will be more marked as April progresses.

Comparison between the business done during the first quarters of 1926 and 1925 shows a very large gain in favor of this year, in some cases as great as 25 per cent. This applies to all lines of machine tools and special machinery. Chicago manufacturers of gears are uniformly busy, their plants being engaged to full capacity. As indicating the steadily increasing activity in this line of production, it may be mentioned that one of the concerns referred to has bought and installed in its plant within the last few months $50,000 worth of machine tools.

Railroads are still holding off in the matter of closing out lists, the only exception reported being the Florida East Coast R.R. which has completed the filling of its last list. Demand for grinding machinery continues satisfactory, although not quite as active as it was during March.

New York

There is little change in the machine tool and machinery situation in this market. New inquiries continue to appear at more or less regular intervals, but orders are slow in closing and many dealers express the opinion that April will show no improvement in the general market situation.

However, the amount of business in prospect is encouraging and a better volume is looked for next month. The present slowness is blamed on the apparent inactivity of large industrialists, who have withdrawn from the market in the past two weeks.

Orders placed in the past week included: 2 die sinking machines, 2 turret lathes, 2 automatic millers, 2 cylinder grinders, 5 vertical drill presses, and one each of the following machines — vertical surface grinder, geared-head lathe, profiling machine, forge lathe, bushing press, 44-in. boring mill, and 10-ft. plate bending roll.

New England

Special machinery orders are coming into the New England territory in large numbers and these, with the volume already placed, will mean not only continued full-time operation of plants but extended operating schedules for several months. The opinion of manufacturers is that further extension of working schedules will be required. Some plants in the territory are now operating until 8 o'clock four nights a week, and plans are contemplated to operate five nights a week until 9 o'clock. A better demand appears for production machinery, a larger percentage of the new business representing foreign trade. Italy, France and Germany are well represented and there is also noticeable buying by Japan and South American countries. Milling machines and multiple-spindle equipments are being bought. Small tools are in good demand.

Southern District

Bad weather has been having a somewhat serious effect on machine tool and equipment business in the Southeast recently, having slowed up industrial operations considerably. Inquiries, however, seem to be generally active, and dealers believe there is going to be a good business this spring and summer.

Textile sales are not very active right now, but will likely improve before the end of this month because of the fact that the textile industry is doing a considerable amount of new construction. Inquiries from this source are fair.

Sales to service stations and small machine shops continue rather slow, and it is not generally believed there will be a great deal of business in this field, at least before the early summer when some improvement is expected. Inquiries are slow. Such sales as are reported are almost entirely for used and rebuilt equipment.

The lumber and furniture industries are buying on a fair basis, but not as actively as a month ago. The outlook here is good, however, as all branches of the woodworking industries are facing a prosperous year.

There is a fair call for road building equipment right now, and it is showing a steady improvement. The outlook is considered very good, with most dealers looking for a record year in this line.

Cincinnati

Nearly all of the machine tool manufacturers of Cincinnati report a slight increase in orders in the past week. The few who did not make a gain express satisfaction with the fact that their sales showed no loss and they have been able to hold their own. Production continues at normal, with the usual forces.

Railroads did a slightly increased amount of buying in the past week, but the orders were small. The purchases of concerns in the automotive industries decreased slightly, orders received from this source being confined to single tools. Some sales were made in the oil fields, and one fair-sized order was received from a university, for tools to be used in its engineering college.

A fair number of orders were received from general machinists and industrial users of machine tools, these making up the greater part of the week's bookings. Nearly all of these sales were of single tools for replacement purposes.

While selling agents report but little gain in the past week they state that they see no reason for being discouraged, as they have done a little better than hold their own in the present conservative market. They continue to receive a satisfactory number of inquiries, and confidence is expressed that sales-resistance will decrease and orders will follow.

Canada

Industrial conditions in Canada continue to improve, with resulting benefit to machinery and machine tool dealers. Plants of the Steel Co. of Canada, the Algoma Steel Corporation, and the British Empire Steel Corporation are busy on business actually on books, and are planning to expand operations. Firms in Montreal, such as the Canadian Car and Foundry Co., the Dominion Bridge Co. and the Vickers plants have a large amount of work on hand and officials state that new business is being strictly scrutinized from a point of view of desirability. The Montreal Locomotive Co. is preparing to take on extra men to produce an order for the Canadian Pacific Railway.

Reports from central Canada state that stove and range plants have well filled order books, radiator plants are busy and agricultural implement manufacturers are working to capacity. Some fair sized orders are reported to have been received from the Canadian Pacific Ry. by two Ontario machine tool manufacturers. Machine shop equipment for the aluminum development in the St. John district of Quebec was placed through Quebec houses largely, although a small amount of the business found its way into Ontario.

Fine Program Ready for A. S. M. E. Providence Meeting

Plans for the Providence meeting of the American Society of Mechanical Engineers are being completed rapidly. The four days from May 3 through 6 will be taken up with a splendid program of technical sessions, entertainment and excursions. The ladies' committee has done splendid work and the meeting will be especially attractive to those ladies who wish to take advantage of the hospitality to be offered them.

The technical program stands unchanged with the exception of the addition of a paper by Luther D. Burlingame who will present the "Basis for Determining the Proportion of Standard T-Slots and Bolts." This paper will be presented at the Machine Shop Practice Session on Tuesday morning, May 4.

There will also be a meeting of the National Screw Thread Commission in connection with the A.S.M.E. meeting at Providence. This will be held on Wednesday morning, May 5.

The Providence meeting is the first meeting to be held in New England since the Worcester spring meeting in 1918. The New England sections of the society are co-operating with the Providence section in plans for the meeting and the Providence Engineering Society is giving a great deal of effort preparing a whole-hearted welcome to the guests.

Stutz Entertains Foremen

Frederick E. Moskovics, president of the Stutz Motor Car Co. of America, Inc., of Indianapolis, was host recently to all foremen and department heads at a dinner. The event was in celebration of the completion of the 1,000th new vertical-eight Stutz. Cash awards were made to foremen whose departments had shown the best spirit of co-operation in production. The chief speakers were: Mr. Moskovics, Edgar S. Gorrell, vice-president, and Charles S. Crawford, chief engineer. Mr. Crawford told of recent experiences in the Pacific Coast territory, where he experimented with the new Stutz in mountain climbing. Mr. Gorrell interested those present with a statement showing progress of sales and distribution. He said the company had 2,414 unfilled orders on its lists worth more than $7,250,000, the cars to be shipped as rapidly as they can be made. Mr. Moskovics said production would be doubled in a short time as soon as material and machinery reserves had been built up.

News of the Automotive Industry

Canada has reduced the duties on imported automobiles, motor trucks and motorcycles valued at not more than $1,200 retail from 35 to 20 per cent. This reduction is contained in the budget submitted to the House of Commons by Finance Minister Robb. On automobiles worth more than $1,200 at retail there will be a reduction to 27½ per cent. These reductions will apply to American makes.

To Canadian automobile manufacturers a drawback of 25 per cent of the duty paid on materials will be paid, provided at least 50 per cent of the cost of the finished vehicle is produced in Canada.

The entire plant of the General Motors of Canada at Oskawa closed down last week, throwing 2,000 men out of work. Employees coming to work found notices posted on the gate saying: "On account of tariff changes the entire plant is closed indefinitely until the company is able to arrive at an intelligent conclusion as to what future course may be considered advisable."

Officials of the Ford Motor Co. of Canada deferred comment on the Canadian government's automobile tariff slash.

"We have not analyzed the report," stated P. W. Grandjean, secretary. "It was a sudden blow and we can't form any opinion until we have considered further the government's proposals."

Operations since the first of the year of the Canadian Ford plant have been good and the present payroll of more than 5,000 men is well up to the average.

Edsel Ford, president of the Ford Motor Co. sailed on the *Aquitania* last week for a six weeks' business and pleasure trip abroad. Mr. Ford will visit the British Isles, France, Italy and Belgium. It is understood he will inspect the various Ford plants abroad and also look into the aviation question.

The Chevrolet Motor Co. broke all previous monthly records in March, when 65,041 cars were produced. Originally March schedule was set at 57,500 cars. Production increased 23,658 cars over March, 1925. January and February also set records, 46,182 units being turned out in January, three times the number produced in January, 1925, and 51,303 cars in February, twice the production of February, 1925. A new record is assured for April production.

Record-breaking sales have followed the introduction of a new line of custom-built coaches by Pierce-Arrow. The number of Series 80 cars shipped during the month of March, 1926, as compared with March, 1925, represents an increase of 73 per cent, the largest passenger car shipments in the history of the Pierce-Arrow Motor Car Co.

Four new directors were elected to the board of the Auto Car Co. at the annual meeting of the stockholders last week. They are: L. L. Woodward, who recently became president of the company; H. Arthur Smith, Herbert Sinclair and W. W. Battles. The company did over $18,000,000 gross business in 1925 and showed $296,000 net profits.

The Mexican government has standardized on Reo speed wagons for its war department. One hundred units will be delivered to Mexico by Reo Motor this year.

Obituaries

ERNEST W. SMITH, president of the Hartford Special Machinery Co., died at his home in Farmington, Conn., last week.

JAMES W. WATT, president of the Watt Car Wheel Co., died at his home in Barnesville, W. Va., on April 6. He was 86 years old.

HARRY E. WITHAM, formerly associated with the Warner & Swasey Co., and with the Kearney & Trecker Corporation, died on March 15 in Denver, Col. He had retired a few years ago.

WALLACE W. TUTTLE, mechanical engineer of the Putnam Foundry Co., Putnam, Conn., died April 6 at his home in that city following a brief illness. He was formerly an efficiency engineer with the Leland-Gifford Co., Worcester, Mass., and had been connected with the Putnam foundry for the past two years.

FRANK SHERMAN MILLS, president and general manager of the Southbridge Foundry Co., Southbridge, Mass., died on April 7 at his home in that city. Mr. Mills was born in Sherbrooke, Que., 59 years ago. Before coming to Southbridge he was treasurer and manager of the Ware Foundry Co., at Ware, Mass. He was connected with the Southbridge company for five years.

Personals

JOHN REIS has resigned as vice-president of the United States Steel Corporation.

JULIUS DUSEVOIR has been appointed field engineer of the Flint Motor Co. of Flint, Mich.

J. M. YOUNG, Toronto, Ontario, has been appointed district sales manager in charge of all Canadian business of the Austin Machinery Corporation, Muskegon, Mich.

HARRY M. CHAMP, secretary-treasurer of the Steel Co. of Canada, Ltd., Hamilton, Ontario, has been elected vice-president of the company.

JOHN C. HAFNER is now works manager of Electrolux, Ltd., Luton, having resigned his position with the Skefko Ball Bearing Co., Ltd., Luton, England.

H. S. VANCE has been appointed vice-president of the Studebaker Corporation of America, and is in charge of production and engineering.

W. L. SCHELLENBACH, consulting engineer specializing in machine design, has moved his offices to Rooms 611-612, Second National Bank Bldg., Ninth and Main Sts., Cincinnati, Ohio.

JUDSON BRADWAY has been re-elected president of the Eclipse Interchangeable Counterbore Co., of Detroit. Other officers are: Wesson Seyburn, vice-president; R. G. Mitchell, secretary-treasurer.

EDWARD G. WILMER, chairman of the board of Dodge Bros., Inc., has been elected president of the company. He succeeds Frederick J. Haynes, who has taken up Mr. Wilmer's duties as chairman.

ARTHUR T. CLARAGE, president of the Columbia Tool Steel Co., of Chicago Heights, Ill., was the speaker at the April meeting of the Chicago Chapter of the American Society for Steel Treating.

C. A. CRUSO, director of purchases of the Cleveland and St. Louis plants of the Fisher Body Corporation, will hereafter purchase all steel for the corporation, succeeding L. W. Cross, who resigned.

EDGAR J. KATES, formerly chief engineer of the oil engine department of the De La Vergne Machine Co., has opened offices in New York as consulting engineer in design and supervision of oil engine plants.

CHARLES KAUDERER, factory and production manager and chief engineer for the Mullins Body Corporation, of Salem, Ohio, has resigned. He has not announced his plans for the future.

NELSON BRANDT has rejoined the sales force of the Link-Belt Co., of Chicago. Mr. Brandt will have charge of the new branch office of the company to be opened in Florida.

CAPTAIN RENE FONCK has become consulting engineer of the Detroit Aircraft Engine Works, of Detroit, which has begun its first production run of 25 engines. Capt. Fonck was one of France's aviators during the World War.

LEO A. DUMSER has been appointed sales engineer in charge of the production service department of the Kearney & Trecker Corporation, of Milwaukee. Mr. Dumser was formerly associated with the Barber-Colman Co., and with the Western Iron Stores Co.

HOMER M. JAQUAYS, manager of the Eastern plants of the Steel Co. of Canada, Ltd., has been elected to the board of directors to fill the vacancy caused by the death of Robert Hobson, Mr. Jaquays is also a director of the Ontario Steel Products Co.

L. W. CROSS, steel purchaser of the Fisher Body Corporation for the past 11 years, assumed on April 1 his new duties as district sales manager in the Detroit territory for the Empire Steel Co., of Cleveland. Permanent offices have been opened at 801 Stephenson Bldg.

A. H. ELLISON has been appointed New York sales repersentative for the Milwaukee Electric Crane and Manufacturing Co. He is located at the company's offices at 50 Church St. B. B. Evans formerly manager of the Pittsburgh office of this company, is now in charge of the Chicago territory.

Indiana S. A. E. Meets

Ralph R. Teeter, of Hagerstown, Ind., was elected chairman of the Indiana section, Society of Automotive Engineers, at the last meeting of the organization. Other officers elected were: George T. Briggs, vice-chairman; Raymond Buckley, secretary, and C. A. Trask, treasurer. Approximately 100 automotive engineers from all parts of Indiana attended the meeting. Among the speakers were Fred S. Duesenberg, president of Duesenberg Motors Co.; Fred Moscovics, president of the Stutz Motor Car Co.; Charles Crawford, chief engineer of the Stutz plant, and Max Thoms, director of inspection for the Marmon Motor Car Co.

Business Items

The Seifreat-Elstad Machinery Co., of Dayton, announces that it will conduct a running exhibition of machine tools at its storerooms, 20 South Canal St., Dayton. The exhibit will be from May 3 to May 15.

The Key Boiler Equipment Co., of East St. Louis, Ill., has taken over the business and plants of the St. Louis Pressed Steel Co. and will continue the manufacture of pressed steel products.

William Jessop & Sons, Sheffield, England, have appointed C. L. Bailey, eldest son of the late C. L. Bailey, to succeed his father as manager of their Toronto, Canada, branch.

The Autocar Auxiliaries, Ltd., Letchworth, Herts, England, manufacturer of the Ashdown rotoscope, is inquiring for agents to handle this product in the American market.

The Lobley Machine Works Inc. has been organized, the new company being a reorganization of the old Empire Machine Works, of 160 Berry St., Brooklyn, N. Y. There is no change in the personnel or the management of the company.

Among the guests at the annual dinner of the Machine Tool Trades Association held in the Trocadero Restaurant, London, England, on March 24, were L. R. Hawkins, W. LaCoste Nielson and W. H. Nowak, from the American National Machine Tool Builders' Association.

Employees of the Diamond Chain and Manufacturing Co., of Indianapolis, who have been in the service of the company more than ten years, were entertained at a dinner recently in the dining room of the plant. Honor guests were men whose services have continued for twenty-five years or more. They were Lucius M. Wainwright, president; Henry Griswold, J. F. Naughton, E. G. Henderson and P. F. Meehan. Seventy others who have been with the company more than ten years attended.

An eight-story building, part of which will be devoted to manufacturing and part to machinery salesrooms, will be erected at the corner of Washington Blvd. and Willard Court, Chicago. The Knourek, Lake & Knourek Building Corporation, which controls the Woodworkers' Tool Works, has taken over from the latter organization title to the property. Some of the floors in the new building will be used by the Woodworkers' Tool Works', manufacturers of machinery, saws, and knives employed in the woodworking industry.

Announcement was made last week that E. A. Langenbach, chairman of the board of the United Alloy Steel Corporation, makers of automotive steel, will retire from active participation in the corporation's affairs. Control of the company will pass to a group of men, who will acquire a substantial part of Mr. Langenbach's holdings of the corporation stock.

The new group is composed of men of experience in the steel industry and is headed by C. S. Eaton of Otis & Co., Cleveland. Mr. Eaton is chairman of the board of the Trumbull Steel Co., and a member of the board of the Ohio Brass Co.

Export Opportunities

An Italian engineer, who has had many years' experience in the machine tool and machinery trades in his country, would like to secure agencies for American machinery of the following types: Automatic screw machinery; automatic hot bolt forging machinery: automatic or semi-automatic milling machines, grinding machines, internal cylinder grinders, crankshaft grinders, internal grinders, surface vertical spindle grinders, piston ring and surface grinders (both horizontal and vertical types), universal grinders, tool and cutter grinders, plano type vertical spindle surface grinders, radius link and hole grinders, heavy face grinders, combined cylinder, surface and radius link grinders, special automatic bore grinders for grinding short, straight and taper holes, horizontal single and double spindle, boring machines capable also of milling and tapping, external radial race-way grinders (machines for grinding external radial surfaces in ball bearings, cones), etc., automatically-multiple spindle horizontal and vertical drilling; automatic lathes, universal radial drilling, portable, sensitive, etc., single pulley captstan and combination lathes, multiple tool lathes and universal milling machines and vertical milling machines, open side planing machines, gear planers for spur, spiral and bevel gears.

In addition to the above tools the above engineer would like to deal also in: self-opening die heads, hand and machine chasers and dies, lathe chucks, ball bearing drill chucks, lathe toolholders, cutting off tools, standard capstan tools, milling cutters, reamers, taps, stocks and dies, etc., high-speed taper shank and parallel stem twist drills in the average sizes, micrometers, calipers, etc. Firms interested may communicate with the National Association of Manufacturers, in New York; the American Chamber of Commerce in Italy; or directly with Benedetto Martelli, Via Porpora 58, Milan (32), Italy.

Calendar of Local Meetings

National Association of Cost Accountants

Boston. April 22. Standard Costs and Variations, A. R. Davis.

Buffalo. April 22. Profit and Loss Statements.

Detroit. April 22. Material Costs Control.

American Society for Steel Treating

Hartford. June. Spring sectional meeting.

Society of Automotive Engineers

Chicago. April 23. "Motorized Rail Car Development," by A. W. Scarratt.

American Society of Mechanical Engineers

Toledo. April 22. Oil and Gas Power Week.

Atlanta. April 22. Joint meeting of the A.S.C.E., A.I.E.E., A.C.S. and A.S.M.E.

Cincinnati. April 23. "Training-Apprentices," by P. C. Molter, National Metal Trades Association.

Colorado. April 23. Metropole Hotel, Denver. Dinner meeting.

Philadelphia. April 23. Engineers Club. "Oil and Gas Power."

New England Meeting. May 3 to 6. Providence, R. I. Chairman of program committee, Luther D. Burlingame.

Forthcoming Meetings

American Welding Society. Annual meeting, Engineering Societies Bldg., New York City, April 21, 22 and 23.

National Foreign Trade Council. Thirteenth national foreign trade convention, Charleston, S. C., April 28, 29 and 30. O. K. Davis, secretary, India House, Hanover Square, New York.

American Gear Manufacturers' Association. Tenth annual meeting, Book-Cadillac Hotel, Detroit, May 13, 14 and 15. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Supply and Machinery Manufacturers' Association. Annual convention, Hotel Statler, St. Louis, week of May 17. F. D. Mitchell, secretary, 1819 Broadway, New York.

Society of Automotive Engineers. Summer meeting, French Lick Springs, Indiana, June 1 to 4. John Warner, manager of meetings, S. A. E., 29 West 39th St., New York City.

Iron and Steel Exposition. Annual exhibit of fuel, electricity, machinery and safety under the auspices of the American Society for Steel Treating, Hotel Sherman, Chicago, June 7, 8, 9 and 10. Secretary, W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio.

National Association of Purchasing Agents. Eleventh annual convention and exposition, Ambassador Hotel and Auditorium, Los Angeles, Calif., June 9 to 12. W. L. Chandler, secretary, Woolworth Bldg., New York.

American Railway Association. Annual meeting of the Mechanical Division (Master Car Builders and Master Mechanics), Atlantic City, N. J., June 9 to 16. V. R. Hawthorne, secretary, 431 So. Dearborn St., Chicago.

Railway Supply Manufacturers' Association. Annual convention and exhibit in conjunction with Division V, Mechanical, of the American Railway Association, Young's Million Dollar Pier, Atlantic City, June 9 to 16. J. D. Conway, secretary, 1841 Oliver Bldg., Pittsburgh.

Society of Industrial Engineers. Thirteenth national convention, Bellevue-Stratford Hotel, Philadelphia, June 16, 17 and 18. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago.

American Society for Testing Materials. Haddon Hall Hotel, Atlantic City, N. J., June 21 to 25. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Society of Mechanical Engineers. Spring meeting, Palace Hotel, San Francisco, Calif., June 28 to July 1. Chairman of convention, Warren H. McBride, the California and Hawaiian Sugar Refining Co., 215 Market St., San Francisco.

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 1, 2 and 3. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foremen's Supply Association. Annual exhibit in connection with the annual convention of the American Railway Tool Foremen's Association, Chicago, Sept. 1, 2 and 3.

Machine Tool Exhibit. Sixth annual exhibition of machine tools at the Mason Laboratory, Yale University, under the auspices of the New Haven Section, A.S.M.E., the mechanical engineering department of the Sheffield Scientific School, and the New Haven Chamber of Commerce, Sept. 7 to 10. Administrative office, New Haven Machine Tool Exhibit, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Eighth national steel and machine tool exposition, Municipal Pier, Chicago, Sept. 20 to 24. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Foundrymen's Association. Second international foundrymen's congress, Detroit, Sept. 27 to Oct. 1, under the auspices of the American Foundrymen's Association. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

The Weekly Price Guide

Rise and Fall of the Market

PIG-IRON buying is slow with market considerably weakened by imports; Philadelphia quotations down 40c. per ton on Eastern Pa. No. 2X and basic; No. 2 fdry., basic and bessemer off $1 at Pittsburgh, during week. Steel prices, however, will probably hold at present levels for at least another two months. Demand is particularly active for pipe, wire products, plates (railway, tank and ship) and agricultural implement material. Non-ferrous metals hold at Apr. 9 levels; scrap (except copper) is easier. Mill prices are $2 per 100 lb. for steel bars, $1.90 for plates, and $1.90@$2 for structural shapes, f.o.b. Pittsburgh.

(All prices as of April 16)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	24.27
Southern Ohio No. 2	24.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.37
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.76
Virginia No. 2	29.17
Basic	22.76
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	21.27
Basic	21.27
Bessemer	21.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.50	3.89	3.25	3.50
No. 12	2.55	3.94	3.30	3.55
No. 14	2.60	3.99	3.35	3.60
No. 16	2.70	4.09	3.45	3.70
Black				
Nos. 18 to 20	3.05@3.15	4.30	3.90	3.90
Nos. 22 to 24	3.10@3.20	4.35	3.95	3.95
Nos. 26 and 27	3.15@3.25	4.40	4.00	4.00
No. 28	3.25@3.35	4.50	4.10	4.10
Galvanized				
No. 10	3.60	4.65	4.25	4.25
Nos. 12 to 14	3.70	4.75	4.35	4.35
No. 16	3.85	4.90	4.50	4.50
Nos. 18 to 20	4.00	5.05	4.65	4.65
Nos. 22 to 24	4.15	5.20	4.85	4.80
Nos. 26 and 27	4.30	5.35	5.10	4.95
No. 28	4.60	5.65	5.25	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	58%	45%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	55%	42%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.60	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60@65%	55%	50%

Electric welding wire, New York, ⅜″, 8.25c.; ¼, 7.85c.; ⅛ to 1/16, 7.35c. per lb. *Flat, ⅛@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.25
Tin, 5-ton lots, New York			65.00
Lead (up to carlots) E. St. Louis	7.80	New York	9.00
Zinc (up to carlots) E. St. Louis	7.12½	New York	8.00

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	19.50	24.00	26.00
Copper sheets, base	22.50	22.50	22.50
Copper wire, base	19.50	16.50	16.00
Copper bars, base	22.12½	22.12½	21.87½@22.12½
Copper tubing, base	24.25	24.25	24.25
Brass sheets, base	18.87½	18.87½	18.87½
Brass tubing, base	23.50	23.50	23.50
Brass rods, base	16.62½	16.62½	16.62½
Brass wire, base	19.37½	19.37½	19.37½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	12.00	12.60@12.95	12.27
Solder (½ and ½), (case lots)	40.12½	42.00	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	81.62½
Commercial genuine, intermediate grade	56.00
Anti-friction metal, general service	31.50
No. 4 babbitt (f.o.b.)	14.00

Nickel, f.o.b. refinery, cents per lb.: Ingots 31 00 Electrolytic 38.00 Shot 32.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.25@12.50	11.25	11.00@11.50
Copper, heavy, and wire	11.75@12.00	11.50	10.50@11.00
Copper, light, and bottoms	9.75@10.25	10.00	9.50@10.00
Heavy lead	7.00@ 7.25	7.50	6.50@ 7.00
Tea lead	5.00@ 5.25	5.00	5.25@ 5.75
Brass, heavy, yellow	7.25@ 7.50	7.25	7.25@ 7.75
Brass, heavy, red	9.50@ 9.75	9.50	8.50@ 9.00
Brass, light	6.00@ 6.25	6.00	6.50@ 7.00
No. 1 yellow rod turnings	8.25@ 8.50	8.00	7.50@ 8.00
Zinc	4.25@ 5.00	4.75	4.00@ 4.50

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade: IC,	14x20	$12.10	$11.45	$11.50
"A" Grade: IC,	14x20	9.70	9.40	9.50
Coke Plates—Primes—Per box 100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0 15@0.20
Cotton waste, colored, per lb.	.10@ .14	.17	.12@.17
Wiping cloths, washed white, per lb	.18	36 00 per M	.16
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb.	3.60†	3.35	4.25‡
Linseed oil, per gal., 5 bbl. lots	.83½	.96	.85
Lard cutting oil, 25% lard, per gal.	.55	.50	48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29

Belting—Present discounts from list in fair quantities (½ doz. rolls).

Leather—List price, 24c. per lin. ft. per inch of width for single ply.

Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%

Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.

First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*In 175 lb. kegs. † Per 150 lb. lot. ‡In 425 lb. barrels.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb	.1662½	.1687½	.1587½
Solder (½ and ½)	per lb.	.4012½	.4025	.36
Cotton waste	per lb.	.13@.17½	.15@.22	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.60
Machine oil	per gal.	35	35	33
Belting, leather, medium	off list	40–5%	40–5%	30–10%
Machine bolts up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.45	1.49
Cloth	3.55	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		3.00@ 3.25
Coke, prompt foundry, Connellsville	per net ton		4.50@ 5.00
White lead, dry or in oil	100 lb. kegs	New York, 15.25	
Red lead, dry	100 lb. kegs	New York, 15.25	
Red lead, in oil	100 lb. kegs	New York, 16.75	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in.; 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in. $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses: ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ill., Chicago — General Metal Spinning Co., 2824 North California Ave.—square shears, circle shears, presses, etc., for proposed 1 story, 40 x 100 ft. factory. Estimated cost $90,000.

La., New Orleans—Wm. B. Reily & Co., Inc., 640 Magazine St.—machinery for the manufacture of cans for packing coffee.

Mich., Detroit—Haywell Production Co., 5116 Bellevue Ave.—screw machine and equipment for machine shop.

Mich., Detroit—T. F. Lesson, 80 Cottage Grove Ave., Highland Park (furnaces and sheet metal products)—sheet metal working machinery for proposed 1 story, 100 x 200 ft. factory. Estimated cost $50,000.

Mo., St. Louis—Baisch Machine & Sheet Metal Mfg. Co., 7700 Gravois Ave.—36 in. shear to cut 14 gauge, 36 in. and $\frac{3}{8}$ plates 9 in. wide and 36 in. brake for bending above plates and forming roll for forming $\frac{3}{16}$ x 3 in. strips 8 in. in diameter. This corrects report in April 15 issue.

N. Y., Buffalo — A. R. Ferguson Mfg. Corp., 567 Washington St.—tool room lathe and shaper.

N. Y., Buffalo—J. Fetter, 745 Jefferson Ave.—9 or 11 in. screw cutting engine lathe.

N. Y., Ithaca—Peters Morse Mfg. Corp., South Tioga St. (addressing machines) — duplex milling machine.

N. J., Weehawken—S. Bleckman Inc.—one 10 ft. power shear 18 gauge, one 10 ft. power shear 10 gauge and one 10 ft. Chicago brake with lower lifting leaf.

O., Cleveland—New Era Electric Mfg. Co., 4121 Woodland Ave.—9 ft. squaring shear.

Okla., Tulsa—Tulsa Ice Machine Co.—machinery for the manufacture of ice making machines for proposed new plant.

W. Va., Huntington—Banks-Miller Supply Co.—one double end motor driven cold riveting machine.

Wis., Green Bay—Brown County Motors Inc., 610 Main St.—bench tools, etc. for proposed garage and machine shop.

Wis., Milwaukee—Gurda & Gurda, 448 Mitchell St., Archts.—sheet metal machinery for proposed 2 story, 50 x 60 ft. factory. Estimated cost $25,000. Owner's name withheld.

Wis., Waukesha — Quality Aluminum Casting Co., Lincoln Ave.—foundry equipment for proposed 1 story, 40 x 120 ft. addition to foundry. Estimated cost $40,000.

Ont., Tillsonburg—Canadian Milk Products Ltd.—complete equipment for proposed machine shops. Estimated cost $50,000.

Australia, Melbourne—Victorian Government Railways will receive bids until June 16 for one high-speed radial drilling machine with equipment.

Opportunities for Future Business

Calif., San Rafael—Pacific Gas & Electric Co., 245 Market St., San Francisco, plans the construction of a machine shop, electric meter and gas meter repair shops, at Court and Second Sts., here. Estimated cost $27,000. Private plans.

Calif., Santa Monica—Douglas Co., 2435 Wilshire Blvd., manufacturers of airplanes, plans the construction of a factory at Clover Field. Estimated cost to exceed $40,000.

Ill., Burnside—Illinois Central R.R., 135 East 11th Place, Chicago, will soon receive bids for the construction of a 90 x 440 ft. inspection shop and 75 x 440 ft. repair shop, etc. Estimated cost exclusive of equipment, $270,000. A. F. Blaess, Ch. Engr.

Ill., Chicago—Jacob Kulp & Co., '33 South La Salle St., is having plans prepared for the construction of a 3 story, 160 x 400 ft. garage and service station including machine shops, paint and tire storage shops on West Congress St. Estimated cost $1,500,000. A. S. Alschuler, 28 East Jackson Blvd., Archt. U. S. Gov. Postal Dept. lessee.

Md., Baltimore—W. Hutcheson, 212 North Holliday St., manufactures of automatic screw machine products, dies, punches, etc., plans the construction of a 1 story, 50 x 150 ft. factory at 1567 Ridgely St.

Md., Baltimore—John C. Raum & Son, 407 South Sharp St., manufacturers of truck bodies, plans the construction of a plant at Taylor Ave. and Curtain St. to double the capacity.

Md., Baltimore — Wilson Nash Motors Co., T. W. Wilson, Jr., Pres., 1100 Cathedral St., will soon award contract for the construction of a 1 story, 90 x 195 ft. service and sales building at 29th St. and Remington Ave. Estimated cost $65,000. Owens & Sisco, Continental Bldg., Archts. H. F. Doeleman, 509 North Charles St., Engr.

Md., Saint Helena (Baltimore P. O.)—Reid Avery Co., 21st and Washington Sts., Philadelphia, Pa., plans the construction of a factory for manufacture of welding wire at Chesapeake and Cleveland Aves. here. Estimated cost $100,000.

Md., Westport (Baltimore P. O.)—McNamara Bros., manufacturers of boilers, tanks, etc., plans the construction of a 1 story, 75 x 100 ft. addition to factory.

Mass., Brighton (Boston P. O.) — W. J. Stober, Ames Bldg., Boston, awarded contract for the construction of a 1 story, 130 x 260 ft. repair and service garage at Beacon and Market Sts., here. Estimated cost $80,000. Federal Motor Co., 5780 Federal St., Detroit, Mich., lessee.

Mass., Everett (Boston P. O.)—Mystic Iron Works, 1 Federal St., Boston, awarded contract for the construction of a 3 story addition to plant here. Estimated cost $40,000.

Mass., Reading—Light Dept. is receiving bids for the construction of a 1 story garage and repair shop. Estimated cost $50,000. G. H. Sidebottom, 101 Tremont St., Boston, Archt.

Mass., Winchester — Bay State Saw & Tool Co., Lake and Main Sts., plans reconstruction of plant recently destroyed by fire. Estimated cost $50,000. Architect not selected.

Mich., Detroit — Edward G. Budd Mfg. Co., 12141 Charlevoix Ave., plans the construction of a 1 story, 132 x 550 ft. press shop for manufacture of metal wheels, at Detroit Terminal Ry. and Charlevoix Ave. A. Kahn, 1000 Marquette Bldg., Archt.

Mich., Detroit — Detroit Garages Inc., Elizabeth St., plans the construction of an 8 or 9 story, 80 x 100 ft. garage. Estimated cost $200,000. Architect not selected.

Miss., Vicksburg — Yazoo & Mississippi Valley R.R., subsidiary of Illinois Central R.R., 135 East 11th Place, Chicago, Ill., has tentative plans for additions and improvements to shop facilities here. A. F. Blaess, Ch. Engr.

Mo., St. Joseph — King Mfg. Co., 230 South Clark St., Chicago, Ill., awarded contract for the construction of a 140 x 480 ft. foundry, and 24 x 40 ft. office building, here. Estimated cost $150,000.

Mo., St. Louis—Southern Wheel Co., Commonwealth Bldg., Pittsburgh, Pa., awarded contract for the construction of a 1 story, 230 x 420 ft. factory at Goodfellow Ave. and Terminal Belt R.R. here. Estimated cost $250,000. Noted Nov. 19.

Neb., Hastings—F. A. Roth Mfg. Co., 1600 South Kilbourn St., Chicago, Ill., manufacturers of brass and iron specialties, is receiving bids for the construction of a 2 story, 100 x 200 ft factory here. Estimated cost $100,000. K. H. Gedney, Hastings, Neb., Archt.

N. J., Elizabeth—Bethlehem Shipbuilding Corp. Ltd., 39 First St., plans the construction of a 1 story foundry. Estimated cost $50,000. Architect not selected.

N. J., Newark—Battery Equipment Co., 266 Plane St., plans the construction of a 1 story plant at 71 South Orange Ave. Estimated cost $50,000. Architect not selected.

N. J., Roselle (Elizabeth P. O.)—Rapid Addressing Machine Co., 46 West 43rd St., New York, N. Y., will soon award contract for the construction of a 1 story, 200 x 321 ft. plant here, Ballinger Co., 100 East 42nd St., New York, N. Y., Archt. Noted April 1.

N. J., Trenton—City Commission will receive bids until April 30 for the construction of a 2 and 4 story fire headquarters and machine shop on Perry St. Estimated cost $389,500. J. O. Hunt, 219 East Hanover St., Archt. Noted April 8.

N. J., Trenton—Essex Rubber Co., Beakes and May Sts., awarded contract for the construction of a machine shop, finishing and inspecting departments for factory. Estimated cost $83,000. Noted Jan. 28.

N. Y., Rochester — Holderle Bros., 339 Exchange St., manufacturers of soda fountains, is having plans prepared for the construction of a 1 story, 47 x 95 ft. shop. Estimated cost $40,000. W. Lee, 134 Fulton Ave., Archt.

Pa., Allentown — Central Motor Ramp Garage Co., awarded contract for the construction of a 4 story, 83 x 141 ft. garage at 28-34 North 5th St. Estimated cost $175,000.

Pa., Meadville—Hookless Fastener Co. plans the construction of a 3 story, 60 x 100 ft. addition to factory. Estimated cost $150,000. Wilbur, Watson & Associates, 4614 Progress St., Cleveland, O., Archts.

Pa., Philadelphia—O. W. Hoffman, 1531 North Stillman St., awarded contract for the construction of a 1 story, 108 x 120 ft. machine shop on 3rd St. Estimated cost $20,000.

Tex., Houston — M. E. Stewart, 1611 Second National Bank Bldg., is having plans prepared for the construction of a 5 story, 52 x 100 ft. garage at Milan St. and Rusk Ave. Estimated cost $175,000. J. Eberson, 212 East Superior Ave., Chicago, Ill., Archt.

Wis., Madison—International Harvester Co., 606 South Michigan Blvd., Chicago, Ill., is having plans prepared for the construction of a 1 story, 120 x 130 ft. sales and service station here. Estimated cost $70,000. W. D. Price, c/o owner, Archt.

Wis., Milwaukee—Seaman Body Corp., 1732 Richards St., is receiving bids for the construction of a 5 story, 100 x 170 ft. factory. Private plans.

Wis., Milwaukee—Stolper Steel Products Co., formerly A. B. & B. Sheet Metal Works, 3300 Fond du Lac Ave., awarded contract for the construction of a 2 story, 36 x 130 ft. addition to factory. Noted Mar. 25.

Ont., Toronto—Terminal Engineer, 220 New Union Station, will receive bids until April 26 for the construction of a car shop for Canadian National Rys.